The Chemical Age

A Weekly Journal Devoted to Industrial & Engineering Chemistry

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Contents

NOTICES:—All communications relating to editorial matter should be addressed to the Editor, who will be pleased to consider articles or contributions dealing with modern chemical developments or suggestions bearing upon the advancement of the chemical industry in this country. Other communications relating to advertisements or general matters should be addressed to the Manager.

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Labour Saving Devices

THE subject chosen for the third conference of the Chemical Engineering Group of the Society of Chemical Industry could hardly have been more opportune. Maximum production with reasonable economy in manual effort was all that was practicable during the strain of war, but the present trend of labour conditions, costs and probable competition has quickened interest—at any rate, among the larger manufacturers—in labour-saving devices. The enormous quantities of materials and goods handled in our munition works, and in the collecting and forwarding bases of our armies, have fully demonstrated the possibilities of mechanical handling. Although the Chemical Industry as a whole does not offer so wide a field for its application, signs are not wanting that the more enlightened are ready and anxious to consider any scheme in which additional capital invested for the reduction of manual labour may be made to pay a good dividend. It has been estimated that a substantial proportion of the men formerly employed in fetching and carrying may ultimately be replaced in this way, and, with increases in wages, mechanical appliances will continue to gain favour.

One's first impression of the Papers presented at the Birmingham Conference was one of disappointment, in that they included only the briefest references to the handling of chemicals and to the application of labour-saving appliances in chemical works. Yet this is really quite natural, for the simple reason that this field has barely been touched upon in the past, the firms specialising in the subject naturally turning their attention first to the readier and larger market of general engineering enterprises. In addition, the notorious apathy of the average chemical manufacturer, now happily in process of reformation, had probably been a not inconsiderable factor. The readers of the various Papers, in the absence of other types already installed in chemical factories, therefore concentrated chiefly upon coal and package handling plant, though it was evident from the discussion not only that the appliances described were capable of far wider application, but that, in order to introduce such plant in the Chemical Industry, the salesman should possess an adequate knowledge of chemical engineering. Another point which was well taken was that the cost of supervising, organising and maintaining labour would offset to a material extent the running expenses of mechanical handling appliances.

Finally, there was some comment upon the choice of the Birmingham Small Arms Company's works instead of a visit to a chemical factory. Quite apart from the fact that advantage should be taken of a visit to a factory of any description in order to broaden one's outlook, the B.S.A. factory was particularly suitable, owing to its outfit of labour-saving appliances. Although information referring specifically to chemical works was not adequately forthcoming, the Chemical Engineering Group, and especially the organisers of this Conference, are to be congratulated on drawing the attention of the Industry to the advantages and economies which inevitably result from that reliability, continuity and automatic operation which mechanical appliances alone can provide.

The Future of Gretna

THE effect of the report of the committee appointed in February of last year to consider the future of the Government factories at Gretna and Waltham Abbey is that the Waltham Abbey works should be shut down and Gretna retained for explosives and other national purposes. The reasons for this decision are shortly stated. Gretna is in a position to manufacture cordite cheaper than it can be made at Waltham Abbey; it also has its own oleum plant, glycerine distillery, ether plant, and solvent recovery plant. It is suggested that the presses for rifle cordite should be transferred from Waltham Abbey to Gretna, and that the plant at Waltham Abbey for black powder and picric powder should be transferred either to Gretna or to some other Government factory.

One of the most interesting points in the report is the proposal that a part of the Gretna ether plant should be used for other purposes than the factory requirements, the conversion, for example, of alcohol to ether and the treatment of the ether alcohol recovered. In the opinion of the Committee it was well worth while the Government considering, in view of the many industries in the country requiring solvents, the production of a supply of cheap duty-free alcohol and ether, which would give a great incentive to all industries of this nature. Being centralised, the Committee believe it could be worked economically, and, furthermore, it would be under close Government control. The Committee are advised that methyl-alcohol of a high grade suitable for the dye industry can be manufactured with slight modifications to the existing plant. It is recommended, therefore, that a small grant should be at once made for the necessary alteration, so that experiments on a commercial scale may be undertaken immediately with the large stock of methyl alcohol in this country to Government account. These recommendations, if carried out, ought not, in the Committee's judgment, to compete with any existing trade, but would be of the greatest assistance in helping existing industries.

One member of the Committee, Sir William Pearce, M.P., dissents from these conclusions on the general ground that the maintenance of so large an establishment as Gretna has become unnecessary. In his view, the Chancellor of the Exchequer's forecast of military expenditure in the near future leaves no possible place for a permanent factory like Gretna with its huge lay-out. As a result of the war, the Admiralty now possess their own factory, sufficient for all naval requirements. A large stock of cordite also remains, and there is a large over-production in the United Kingdom of both oleum and glycerine. If, therefore, any Government factory is required by the War Office it should, in view of the greatly reduced output required, be Waltham Abbey rather than Gretna. The main report, he claims, ignores the enormous capital cost of Gretna, approaching £150 for every ton of cordite yet produced. He submits, however, that it would be wiser to cut this loss once and for all than to continue in a locality with inherent disadvantages a huge factory which only a world-war called into existence, and the retention of which only the probability of a future world-war could justify.

It seems to be assumed that the recommendations will go through as they stand, but this is not certain yet, as expert opinion is by no means unanimous on some points. There is a general feeling that the Report might have carried greater weight if the composition of the Committee had been a little more representative of the best technical knowledge on the subject. The reference to the manufacture at Gretna of methyl-alcohol for the dye industry is difficult to understand at first sight. What the Committee have in view is, presumably not its manufacture, but its purification.

The Fuel Research Station

THE Report just issued by the Fuel Research Board is mainly descriptive of the experimental plant which has been laid down adjacent to the East Greenwich works of the South Metropolitan Gas Company. The material contained in the Report is scarcely of interest to chemists in general, but is of more immediate concern to those responsible for the carbonisation of coal. For this reason we do not propose to give more than passing attention to the questions raised, particularly in view of the adequate manner in which the Report is being dealt with by our contemporary *The Gas World*. The Fuel Research Board set out originally to determine to what extent the consumption of raw coal could be replaced by the products of its carbonisation, and the methods whereby the greatest economy in fuel could be ensured. To-day, of course, a mass of knowledge exists on the practical side of fuel economy; but, even with coal at its present price, there is so much obvious inertia on the part of consumers that even the most elementary steps towards improvement are not taken. Unfortunately, cheapness invariably lends itself to abuse, and it is difficult to eradicate the habits and indifference which were acquired during the time when coal stood at what now appears an absurdly cheap figure. It might be imagined that the situation is now sufficiently ominous to rouse even the most lethargic consumer. Many, of course, consoled themselves during the war with the assumption that the increase in cost was only of a temporary nature. Now, however, in post-war days we are faced with the prospect that, instead of a reduction to 1914 costs, which some had confidently anticipated, the prevailing prices will not only be maintained, but are likely to be permanently increased.

The Board has attacked the problem from the standpoint that 1 ton of good coal, burnt under the ideal conditions of the calorimeter, should give about 30 million B.Th.U. With coal at 30s. a ton, therefore, the cost of a million thermal units is a shilling. So far as universal carbonisation might affect the solution of the fuel problem, it is pointed out that any such process involves the sacrifice of a portion of the original potential energy of the coal, and in some cases the sacrifice may amount to as much as 10 million units. With coal at 30s. a ton this means the loss of 10s. per ton, so that the process to be commercially sound must show subsidiary advantages which are equivalent to this loss. The subsidiary advantages are, of course, to be looked for in the direction of by-products; but the Board seems to think that, even if the prices of by-products were raised, it does not follow that the enhanced cost of the thermal units sacrificed would be met.

Nitrogen Fixation

THE account published in this issue of the Georges Claude process (the rights in which were recently acquired by Cumberland Coal Power & Chemicals, Ltd.) for the fixation of nitrogen from the air will be read with great interest. The case is quite naturally stated by the company in its most favourable light, but even if the full 100 per cent. of the claims for the French process should not be realised, enough remains to make its application in England on the large commercial scale contemplated a matter of national as well as of scientific importance. We hope, by the courtesy of Cumberland Coal Power & Chemicals, Ltd., to be able to supplement the description now published by a more detailed examination of the process in later issues. In the meantime the country may be congratulated on the fact that its advantages have been permanently secured by the enterprise of a British Company in acquiring the rights in the process, and in planning its application and development on such a large and thorough scale.

Briefly the Claude synthetic ammonia process differs essentially from the Haber process by aiming at increasing instead of diminishing the pressure at which nitrogen and hydrogen are made to combine to produce ammonia. While the working pressures under the German process were from 200 to 300 atmospheres, still further reduced by American modifications to 150, the pressure of combination under the French process is raised to 1,000 atmospheres (14,000 lbs. to the square inch) without reducing the temperature at which the combination is affected. With a view to the cheaper production of ammonia for fertiliser purposes, M. Claude has devised a modification of the Solvay ammonia soda process for the production of chloride of ammonia and bi-carbonate of soda, and it is claimed by the Company "that the cost of production of sulphate of ammonia by the French process will be considerably lower than that of the Haber process, while the production of chloride of ammonia for agricultural purposes will ensure still greater economical advantages as compared with sulphate of ammonia." Further advantages claimed are an improved method of making hydrogen from producer gas, and the simplification and cheapening of the works plant.

It is proposed presently to form an English Company, to be known as Atmospheric Nitrogen & Ammonia Products, Ltd., with a capital of two and a half millions, to acquire the whole of the share capital of Cumberland Coal Power & Chemicals, Ltd., and to erect a synthetic ammonia plant, &c., on freehold land adjoining the Allerdale coke oven plant at Great Clifton, Cumberland. The first unit of this plant to be installed will provide for the production of 50,000 tons of sulphate of ammonia, and a small plant will be erected for the production of chloride of ammonia and extended proportionately to the demand for it as a new fertiliser. It will be seen that the scheme which the Company have in view is of considerable size and importance, and the further developments will be watched with interest.

The Petrol Problem

DR. W. R. ORMANDY promises in the next number of *The Observer* an interesting article on the question of petrol substitutes and the Imperial action to be taken thereon. In the meantime his summary of the present position as regards the world shortage and the steadily growing demand serves as a useful preliminary study of the problem. The approximate world's production of crude oil has increased from 50 million tons in 1912 to 75 million tons in 1919. As indicating the rapid increase in the demand for power purposes, he estimates for the year 1919 an increased consumption of $3\frac{1}{2}$ million tons of liquid fuel. Assuming the average percentage of volatile liquid fuel to the crude to be 20 per cent., this $3\frac{1}{2}$ million tons of petrol would require over 17 million tons of crude oil for its production. In a word the demand is growing at a rate out of all proportion to the growth of the supply. New fields, of course, are being rapidly developed, for the most part in non-British territory, but the fullest prospective increase of yield will be more than absorbed by the expansion of industry. The petrol question, Dr. Ormandy insists, must be looked upon as a world question, and he sees no hope in the popular remedy of substituting paraffin oil for petrol. The price of the former is steadily rising, for the reason that the largest producers are cracking more and more paraffin into petrol, and eventually its price will be entirely dominated by the price of petrol. To increase the use of paraffin oil is merely to rob the world of prospective petrol. Unless, therefore, the whole industry of the high-speed internal combustion engine is to be restricted, help must be sought in some substitutes for petrol. If Dr. Ormandy can give us some practical suggestions for the production of efficient substitutes he will be rendering a public service of high importance.

The Calendar

May		
1	Royal Institution of Great Britain: Annual Meeting of Members, 5 p.m.	21, Albemarle Street, London, W.1.
3	Society of Chemical Industry (London Section): Annual Meeting. Papers by F. G. Donnan and J. I. Orme Masson; P. F. Frankland and A. F. Garner; P. F. Frankland, F. Challenger and Miss D. Webster.	Rooms of the Chemical Society, Burlington House, Piccadilly, London, W. 1.
5	Society of Arts: "A Photographic Research Laboratory." Dr. C. E. Kenneth Mees. 4.30 p.m.	John Street, Adelphi, London.
5	Society of Public Analysts: Papers by C. A. Mitchell, E. R. Dovey, H. Droop Richmond and Edith M. Ison	Rooms of the Chemical Society, Burlington House, Piccadilly, London, W.1.
6	Chemical Society: Ordinary Scientific Meetings. 8 p.m.	Burlington House, Piccadilly, London W.1.
6	Royal Society of Arts: "Researches on the Elastic Properties and the Plastic Extension of Metals." Professor W. E. Dalby.	John Street, Adelphi, London, W.C. 2.
6–7	Iron & Steel Institute: Annual Meeting and Annual Dinner.	Great George Street, Westminster.
7	Society of Chemical Industry (Manchester Section): "Azo Dyes from Alpha - Naphthylamine and its Hydrogenation Products." F. M. Rowe.	College of Technology, Manchester.

Chemical Engineering Group

Some Impressions of the Birmingham Conference

(From Our Own Correspondent)

It is not easy to speak in other than superlatives of the brilliantly successful Third Conference of the Chemical Engineering Group, just completed in Birmingham. Every one who attended the meetings was unanimous in saying that the gathering fully attained all possible good results, and reflected the greatest credit upon the hon. secretary of the group (Mr. H. Talbot) and upon the hon. local secretary of the Society of Chemical Industry (Mr. F. R. O'Shaughnessy) in whose hands the arrangements had rested.

The conference started with the descent upon Birmingham on the morning of the 23rd ult. of a host of alert-looking gentlemen, who announced to all and sundry that they were chemical engineers, and what is more, appeared to be almost sinfully proud of the distinction. The porter at the station from the Grand Hotel—the headquarters of the Group during the Conference—gazed at the invaders in astonishment, and then discreetly effaced himself, leaving to the new arrivals the task of conveying themselves and their belongings, naturally with the minimum expenditure of labour, to their temporary home. From this time until about 2 p.m. the number of chemical engineers in Birmingham increased at an astonishing rate, newcomers arriving from London, Dublin, Belfast, Glasgow, York, Peterborough, Bristol, Plymouth, Liverpool, Manchester, Widnes, and indeed from nearly every town of importance in the British Isles, until fully 50 gentlemen had foregathered in the hotel prior to the afternoon meeting of the Conference. The place was full of them. They were in every part of the hotel, and huge posters announcing their coming meetings were to be seen on all sides. Birmingham's astonishment at these strange happenings was aroused to the full.

The opening session of the Conference began on Friday, at 3.0 p.m., in the University, under the chairmanship of Mr. Calder, about 120 persons being present. Mr. Calder announced that, by the irony of fate, Mr. E. G. Hunt, of Chance & Hunt, Ltd., who was to have presided over the meeting where methods of saving labour were to be discussed, was prevented from attending by having to be present at a meeting where the conditions under which any labour at all would be available were to be settled. The first Paper, by Mr. H. Blyth, on "Modern High Speed Electric Telpherage and its Applications in Chemical Works" was of great interest as showing modern applications of the relatively new telpherage system of transport, and served to emphasise the very backward state of this country as compared with either Germany or the U.S.A. in its employment in chemical works. The author was extremely enthusiastic in support of his telphers, and illustrated his lecture with some very fine lantern slides. He was almost truculent in his request for criticism of his figures of cost and performance, with the result that his interrogators let him down very lightly.

The next Paper was on "Pneumatic Conveying of Coal and Similar Substances," and the author, Mr. H. J. H. King, after announcing that he had no intention of reading it all, justified his announcement by reading every word but the title. To do him justice, he read extremely well, and the Paper was short and of intense interest, judging by the discussion it evoked. Mr. Phillips, the engineer directing the plant described in Mr. King's Paper, gave personal experiences of its working, and expressed his willingness to show it to anyone present at the meeting on due notice being given—an announcement that was loudly cheered.

The third and last Paper of the afternoon was by Capt C. J. Goodwin, on 'Some Notes on Portable Conveyors and Transporting Trucks" and was illustrated by some excellent slides and working models. The author had intended showing a model of a portable conveyor in work, but found to his surprise that an enterprising assistant had secured 56 lb. of hard peas for demonstrating the action of the machine, a feat which was, of course, impossible to accomplish. The afternoon session closed at 5.15 p.m., with a hearty vote of thanks to Mr. Calder for presiding, and 72 of the company then adjourned to the Grand Hotel for an informal dinner at 6.15 p.m., under the chairmanship of Mr. C. A. Smith. The dinner was a most enjoyable affair, and served as an excellent preparation for the evening session of the Conference, which began at 7.40 p.m., again in the University, under the chairmanship of Mr. Smith.

The first Paper at the evening meeting was on "Pneumatic Conveying of Granular Substances, including Chemicals," by Mr. Gordon S. Layton, and again aroused the keenest interest. The question of pneumatic conveying is evidently exercising the attention of very many progressive chemical engineers and works managers, and it is obvious that the method is capable of much further use in chemical works than is at present the case.

The fifth Paper on "The Development and Use of Labour-Saving Devices in the American Chemical Industry" was, according to the hon. secretary, still in the post, but he had been able to secure a short Paper by Mr. S. H. Johnson, Manager of the Automatic Department of Messrs. W. & T. Avery, Ltd., on "Automatic Weighing and its Applications in Chemical Industry," in its place. Mr. Johnson's contribution, although prepared at extremely short notice, was of great interest and value, and included some excellent slides. The discussion on the Paper afforded the first opportunity for a gentleman whose thirst for knowledge was as commendable as his experiences of the accuracy of large scale weighing had been unfortunate. He seemed to want a machine taking a load of a few tons to have the sort of delicacy that is obtained on a small scale by using an evacuated balance case and viewing the scale pointer from a distance with a telescope. Mr. Johnson was accorded an especially hearty vote of thanks for his Paper.

Mr. H. Varndell, the author of the sixth Paper, on "The Importance of the Mechanical Handling of Material and its Relation to Production Costs," put forward some very telling examples of the application of the labour-saving devices he advocated from experiences during the war. He had the advantage of support from the managing director of a firm with the largest installation of the Gravity Conveyor in the United Kingdom. The slides illustrating the Paper were very varied in character, although there was a certain incongruity, not to say indignity, in seeing barrels—which might very probably contain the mainstay of British finance—disporting themselves on a conveyor that seemed to be a combination of a Helter Skelter Lighthouse and Hampton Court maze. It is hoped that no indignity was intended, although appearances were very suspicious.

The last Paper was practically a corollary to Mr. Johnson's Paper earlier in the evening, and again aroused the enquiring spirit of the gentleman with the mania for exact weighing.

The meeting closed with a hearty vote of thanks to Mr. O'Shaughnessy for his services in helping to arrange the

Conference and to the Chairman for presiding. Mr. Garland, who moved the latter vote, accurately expressed the feeling of the meeting when he said that the pleasure all had experienced in being present was derived in no small degree from the genial and inspiring way in which the Chairman had conducted the proceedings. Replying to the vote, the Chairman stated that he had never before attended a meeting of a similar character where authors had stuck so strictly to business as in the present case, and he congratulated the Group on the excellent way in which its affairs were conducted. The proceedings at the University then terminated, and between 30 and 40 of the company adjourned to the Grand Hotel for supper—an exhilarating gathering—and a mysterious "Board Meeting" for the elect, the weighty business of which apparently extended well into the small hours.

On Saturday morning, April 24, a visit was paid, by kind permission of the Chairman and Board of Directors, to the works of the B.S.A. Company, Small Heath, the party of 20 leaving the hotel at 10 a.m. in a motor charabanc, and returning at 12 noon. The chief chemist—Mr. F. C. A. H. Lantsberry—had made every arrangement for the comfort of the visitors, who were conducted round the works in three parties by different routes under the direction of members of Mr. Lantsberry's technical staff. The visit was of the greatest interest to all who were enabled to attend, and very hearty thanks were accorded to the gentlemen who had acted as guides after its conclusion. The party returned to the Grand Hotel for luncheon, and then dispersed.

It has already been said that it is impossible to speak of this Conference in other than terms of the highest praise. Perhaps the feeling of all members of the party, and especial y of those 50 or so who stayed at the hotel, is best expressed in the following statement made to the hon. secretary by a gentleman who attended just before his departure. Said this gentleman: "I have never before been to a scientific meeting of this kind, because I thought they were uninteresting and as dull as so many charity sermons, but I have thoroughly *enjoyed* these. I have had more pleasure, done more business, met more interesting and important people, and learned more useful things in this day and a half than I have ever done before in my life in a much longer period, and I want to say this—I don't know where your next Conference is going to be, and I don't know what it is going to be about. What's more, I don't care, but I am most infernally sure of this—*I'm coming*, if I'm alive." The speech is given almost verbatim; the expression may be inelegant and the syntax capable of improvement, but its sentiment will find an answering echo in the breast of every one who was privileged to attend.

Labour-Saving Devices in Chemical Works

Papers and Discussions

Electric Telpherage in Chemical Works

In a Paper on "Modern High-speed Electric Telpherage, and its Applications in Chemical Works," Mr. H. Blyth, A.M.I.Mech.E., A.M.Inst.C.E. (chief engineer, telpherage department, Strachan & Henshaw), said the telpher was a particularly convenient and simple machine for conveying any class of goods or materials over a moderate distance with a minimum consumption of power and at a low maintenance cost. This system was invented in the year 1882, 38 years ago, by Professor Fleeming Jenkin, an eminent electrical engineer, who began his practical career in Manchester. A telpher company was formed in 1883, and one of the first telpher lines to be erected was at Weston, in Hertfordshire. It was 700 ft. long, consisted of round iron rods, and carried a total rolling load of 1 ton at a speed of 5 miles per hour. No serious attempt appeared to have been made to put telpherage upon a practical commercial footing in this country until about 1903, when Siemens Brothers, having obtained information of telpher practice in the United States, began the development of this conveying system at Woolwich, and later continued it as Stafford for a time. Some of the plants installed by Siemens Brothers may be seen at the Associated Portland Cement Co.'s works, Gravesend; Peases' West Colliery, Crook, Durham; Cape Copper Co.'s works, Swansea; and Newport Gas Works. Later on Siemens Brothers handed the telpher business over to Strachan & Henshaw.

Progress had also been made with telpherage in Germany, but upon rather different lines, and most of the larger chemical works in Germany used telpherage for unloading from barges and railway trucks exclusively. For example, Frederick Bayer & Co., at Leverkusen, used telphers for unloading salt, sodium nitrate, coal, pyrites, &c., from barges and conveying to storage; also for transmission from storage to various parts of the works. Again, at the superphosphate works of H. & E. Albert, Biebrich, making 80,000 tons of superphosphate per annum, telphers were used for unloading raw materials from trucks and conveying to the stores and mills; also for bringing materials to the mixing points and handling the finished product. Telphers were also used at the Knapsack Calcium Carbide Works near Cologne.

Some of the latest applications of electric telpherage in this country were to be seen at Plymouth Gas Works, from which, in addition to gas and coke, there was a large output of chemical products; Nobel's Works, Pembrey, near Swansea; the gas works at Woolwich Arsenal, where there were eight telphers, each of 50 cwt. capacity, and about half a mile of track. At Wolverhampton, the electricity works and also at the gas works; also at Widnes, Warrington, Liverpool, Manchester, Glasgow, Hull, Dundee, &c., &c.

The modern telpher was quite different in principle from the more generally known type of transporter, which operates upon the bottom flange of an "H" beam. With the telpher system it was possible to negotiate curves of very small radius; for example, at Southampton Gas Works a telpher machine weighing 3 tons, carrying a load of 2½ tons (total 5½ tons), traversed a curve 9 ft. 6 in. radius with perfect ease. Radii of 15 ft. and 18 ft. were common in gas works where the space was often restricted, although larger radii were, of course, preferable where space permits.

Discussion

In reply to Mr. S. J. Tungay, who raised the question of the percentage allowed for depreciation, Mr. Blyth said that 12½ per cent. for machinery depreciation was a fair figure; for structural work the percentage should not be more than 3½ per cent. The question of depreciation lay largely in that of structure. Repair work in a telpher was not more troublesome than in a long conveyor. At Plymouth a conveyor was being removed to make way for a telpher.

Pneumatic Conveying of Coal and Similar Substances

Mr. H. J. H. King, M.I.Mech.E., managing director of H. J. H. King & Co., Ltd., gave details of a pneumatic suction plant in connection with the power house at Boots Pure Drug Co., Ltd., Island Street, Nottingham. The power house is surrounded by the large chemical factories of the firm, and it was essential that all dust should be eliminated in the unloading of coal. With this point in view, the pneumatic suction plant was adopted in preference to bucket elevators and conveyors. The problem was to move 20 tons an hour of coal of a quality from fine slack to lumps up to fully 4 in. cube to a central bunker.

The suction plant used consisted of, first, a pump 28 in.

diameter by 14 in. stroke, driven through gear wheels by a two-speed Lancashire motor of 70 H.P. The pump was what might be termed a "dry air pump," having Corliss inlet valves and leather expansion valves. Close to the pump was provided an elaborate dust collector, consisting of 16 flannel bags, providing a large area for filtering the dust from the air before reaching the pump. The bags were placed vertically, and the incoming air was given a vertical downward direction. The bags were open on the inside to the incoming air, and the collector was provided with a large chamber at the top and a large chamber at the bottom, the bags themselves being open at each end. The air passed out radially from the bags before reaching the pump. The direction of the incoming air vertically descending allowed a large quantity of the particles of very fine dust to be precipated straight into the bottom chamber, as the velocity of the air was approximately 40 ft. per second. On the bottom of the dust collector was provided an automatic discharge valve, which automatically discharged into bags any dust that dropped through the bags. There was also provided a circular scraper, which swept down the conical section and automatically cleaned the dust collector. This very fine dust was collected in bags and sold to the foundry trade for dressing moulds, and had proved to be a useful by-product to any coal suction plant. The pump and the dust collector were placed on the ground level in a separate engine house, and from the dust collector to the actual discharger over the bunker was approximately 100 ft. of 10 in. steel piping, and special swelled bends of 10 in. to 13 in. diameter. The swell bends are to allow for an easy travelling round of each bend to prevent frictional losses.

The coal discharger consisted of a cast-iron vessel with two King's patent rotating valves in the form of a slightly conical taper divided into four sections, one portion of the circular valve being under vacuum, and the other under ordinary atmospheric pressure. The outlet of the valve was larger than the inlet to allow for the coal which was in the valve to drop out easily. Over each valve was also provided a four-armed sweeper to prevent any fine damp coal forming a cone inside. This discharger was provided with two inlets with fullway bored valves, so that the coal could be either drawn from the water side or from the land side at will. After the coal had been deposited in the main discharger, there was provided a supplementary discharger, consisting of a vessel 6 ft. high by 30 in. diameter, with two inlet pipes of 8 in. diameter to provide a contra flow, so that any particles of the coal dust in the air would meet one another in the 30 in. box, and in practice hit one another at an equal velocity, so that the small particles would be deposited by a supplementary discharge valve, which was set to run very much slower than the main discharger valves. The main discharger valves were driven by worm gear, one right-hand thread, one left-hand thread, so the end thrust on the two worms was neutralised.

In addition to these ball bearing end thrusts there was provided a small motor that drove all three valves, and was coupled up with an electrical device designed by Mr. Phillips, electrical engineer to Boots Pure Drug Co. This arrangement allowed that should anything happen to the top discharge valves, so that the small 3 H.P. motor cut out owing to overload, then the main switch down below operating the main power motor also cut out; this prevented any flooding of the pipes and dischargers.

Discussion

Capt. C. J. Goodwin asked for information as to the rate at which the cast iron was worn away at the bends. In America, in similar types of plant, acid resisting, or silicon iron was used with success. Was there much difference in the efficiency of the plant and its working if the coal were damp or contained much moisture?

Mr. King replied that extra vacuum would be allowed for damp coal. He could not speak exactly as to the wear at the bends. Less horse-power was required if the radius there was easy.

Mr. Tungay inquired as to the results in the conveyance of material having a higher specific gravity than that of coal; also as to the breakage of coal through the elevators and at the bends.

Mr. J. Arthur Reavell inquired as to the experience with regard to damp crushed wood, sawdust and material from tannery pits.

Mr. H. Sissons sought information regarding the conveying of fine slack with 25 per cent. of moisture.

Mr. J. C. Mann asked if fuel could be distributed by the apparatus in various parts of a works.

Mr. A. E. Malpas (Widnes) said in handling boiler ashes in a pneumatic installation at Liverpool there was a good deal of damage at the bends. Some years ago he considered the question of distributing soda ash between two points, direct from a furnace to a crystal soda plant, but for want of sufficient backing he did not proceed with the scheme, although to-day the position would, perhaps, be reversed. In that case they fell back on the ordinary methods by loading into wagons, and shunting down to the job. The method of the pneumatic handling of substances had been applied by the Post Office to facilitate the transmission of telegrams, &c., and some years ago he had some experience with a pneumatic installation at a large works. It worked satisfactorily, execpt that in times of excessive rain condensation took place in the distributing pipes. The papers got wet. The air was then pre-heated, and the difficulty did not recur.

Mr. E. G. Phillips, who is identified with the installation described, told the Conference that the experience with the plant was better than anticipated. Unloading of coal was absolutely dustless. The amount of breakage of coal was small; with an easy bend the coal was not broken. The wear on the pipe was only at the bends, and the life of the bends was approximately six months. The bend was so constructed that it was not damaged entirely; the mischief was at the point at which the material impinged on the metal.

In reply, Mr. King said coal could be distributed in various parts of a yard without difficulty. Sea sand, which was damp, could be dealt with; there was liability to stick in the pipe, however, with 8 to 10 per cent. of moisture. Many things besides coal could be dealt with effectively. Wood chippings, &c., had been conveyed, as well even as steel nuts.

Portable Conveyors and Transporting Trucks

In "Some Notes on Portable Conveyors and Transporting Trucks," Captain C. J. Goodwin, A.C.G.I., B.Sc., A.M.Inst.C.E., stated that, although portable conveyors had been used for years, such machines had usually been crude and heavy, and it was only in recent years that their design, manufacture and, above all, standardisation had been studied seriously. Capital outlay and the equivalent cost of hand labour (not neglecting the possibility of subsequent increases in wages) were the chief factors in considering the adoption of portable conveyors and similar plant.

Under average conditions of loading, the following outputs were attainable from modern portable conveyors:—

Width of belt, in.	Capacity, tons per hour — Coke.	Coal.	Earth.	Soda Ash or Cement.	Fine dry crystals.	H.P. of motor required according to length
18	17	30	43	53	50	3 to 5
24	31	52	78	93	90	3 to 7½

The outputs of conveyors with steel flights for inclinations up to 35 deg. was about one-half of those given above, and in both cases the actual power consumption was considerably less than the rated output of the motor.

Comparison of Cost with Hand Labour

Assuming that trucks of coal were to be unloaded and taken to a storage pile or hopper 30 ft. or 40 ft. from the railway track; further, that 20 tons had to be unloaded daily under the hand method, this would be done by shovelling from the truck into wheel-barrows, wheeling up an inclined runway, dumping and returning empty to the truck. Two men to unload the two trucks and feed into barrows in one day. At least three men would be necessary to wheel and dump the material. Assuming daily wage of these five men averages 13s. each day, this, for a working year of 280 days, would cost in labour £910. This operation carried out by mechanical handling would be performed by a portable conveyor, say, 50 ft. long, working on an incline of, say, 30 deg., the receiving end remaining stationary at the truck door, and the discharge end swinging round in an arc of a circle. The smallest type conveyor made would

handle the quantity in less than one hour, but it could not be hand fed from the truck at this rate.

Assuming that two men were employed to shovel from the truck into the conveyor receiving hopper, these two men would unload the two 10-ton trucks in one shift. The cost worked out as follows :—

Two men at 13s. per shift each for a year of 280 days	£364
One portable 50 ft. conveyor with 3 H.P. electric motor and wheel truck. Capital cost £500	
Interest maintenance and repairs at 20 per cent.	50
Sinking fund, assuming the conveyor has a life of four years	125
Cost of electric power at 5d. per kilowatt-hour	90
Cost of one belt renewal per year (an extreme case)	64
Contingencies	25
Total	£718
Yearly saving by utilising conveyor	£192

This yearly saving would increase very greatly as the quantity of material to be handled increased—*i.e.*, as the conveyor was worked more nearly up to its capacity ; but the above example was purposely selected in order to demonstrate the saving which was possible even under favourable conditions.

For places where no electric power was available, this machine could also be supplied with self-contained petrol engine.

Discussion

In reply to a query, Capt. Goodwin said that in his opinion the transporting truck was eminently suitable for the handling of carboys. Protection by lead covering could be afforded if there were a likelihood of spilling acid, &c.

Mr. H. Blyth was of opinion that the method described might be very useful if applied in conjunction with other means of handling ; it might be of value worked in connection with a telpher plant, and particularly in relation to lifting coal from barges. The latter problem had been tackled, but there were cases where it did not pay to put in a telpher line, and where it was better to put the coal on the bank. If the mechanism were robustly built he did not doubt that there would be considerable field for its usefulness.

About 100 members dined at the Grand Hotel, Mr. Smith presiding. The loyal toast was the only one proposed.

The Evening Conference

Business was resumed at 7.30.

Addressing the Conference, the chairman stated that he considered such conferences were invaluable, not so much on account of what was said, but because they assisted in the creation of the right kind of atmosphere. The difficulty chemical science was up against was national indifference, and it was the function of such organisations as the Chemical Engineering Group to concentrate so as to arouse enthusiasm and interest, and to create an atmosphere in which chemistry could thrive, and to come to its own, just as mechanical engineering did in the Victorian age. He believed when a proper account was written of the industrial and scientific achievements of this part of the twentieth century that chemical science would be found to have been one of the greatest factors.

Pneumatic Handling of Granular Substances

"Pneumatic conveying of granular substances, including chemicals," was the subject of a Paper by Mr. Gordon S. Layton, of Messrs. Robt. Boby, Ltd.

Like many other things, the author stated, pneumatic conveying was originally discovered in this country, was neglected, and was finally taken up and improved upon by Germany.

It was now recognised that the pneumatic conveyor was not suitable for all circumstances. Where it was a question of conveying or elevating material from one definite point to another definite point, then, under ordinary circumstances, the lower power consumption of bands and elevators gave them a decided advantage ; but where the material had to be gathered from a large area, as for example the hold of a ship or a storage floor, then the wages cost in bringing the material to a bucket elevator far outweighed the saving in power, and the fact that the suction nozzle of a pneumatic plant could be brought to the material with little or no difficulty, resulted in such a reduction in the wages bill as more than paid for the extra power consumption. Further, when it was necessary to convey material across obstacles, such as streets, railways, rivers, &c., the pneumatic conveyor offered great advantages owing to the ease with which a pipe-line could be erected and supported.

The ratio of the average capacity to the maximum or nominal capacity was considerably higher with the pneumatic conveyor than with the bucket elevator. Thus, with one hundred tons per hour maximum capacity in each case, the pneumatic conveyor would unload a cargo at an average overall rate of 70-75 tons per hour, while the bucket elevator would not exceed 55-60.

This point was of great importance for water borne materials, as it cut down the time of unloading and therefore reduced demurrage. Other advantages were to be found in dustless working, greater independence of labour and independence of weather and tide conditions.

When the pneumatic conveyor was first introduced it was apparently considered that a solid core of material would be carried along the pipe, either by suction or by pressure ; the result of trying to attain this idea was that the power consumption of the early plants was very high indeed. Later on, the Germans showed that this idea was quite incorrect and that much greater efficiency could be obtained by conveying a comparatively small core of material in a large stream of air. The conveying was effected through friction between the air and the skin of particles conveyed, and this friction resulted in an expansion of the air.

Experience with pneumatic conveyors had been chiefly gained when handling grain, but it was quite obvious that many other granular substances could be conveyed with equal success. Such heavy bodies as chain slings, wire ropes, spanners and pieces of wood, had been found in grain which had been unloaded from ships by pneumatic conveyors. It had long been known that small coal and coal dust could be handled successfully, and the company had in hand at present plants for conveying dry salt, sugar, powdered charcoal, superphosphates in their raw state, and cotton seed, which last was a very difficult material to convey, owing to its clinging nature. The most usual form of plant was the suction type, in which the direction of working was, in accordance with the flow of air, inward toward the centre ; the working could, however, be reversed, the material being conveyed by blowing out from the centre to one or more points as required. For various reasons it was not usual to construct blowing plants for a large capacity. A difficulty arose in connection with dealing with the dust, as it was obviously more convenient to do this when the material was being deposited at one centre, than to do so when it was being deposited at a variety of stations.

With regard to the cost of installation, this depended entirely upon the nature of the plant, but as a very approximate estimate it might be said that an intake plant with a capacity of 20 tons to 30 tons, would cost to-day about £75 per ton of material per hour ; while in the case of a large plant of, say, 200 tons to 250 tons per hour capacity, the above figure would fall to about £50. Where material was conveyed horizontally, £40 to £50 per ton of material conveyed per 100 ft. of distance, would be a very approximate cost of installation.

Discussion

Capt. C. J. Goodwin said the question of the filtration of dust after the material had been conveyed to its destination was most important, and much investigation had yet to be made. Had the possibility of the electrostatic deposition of dust been thought of ? It might be applicable in the case of large installations. The difficulty experienced in cleaning bags might possibly be minimised if there were a combined system of cyclones and bag filters, the latter to deal only with the finest particles. A third possibility was one which included substitution of a different type of vacuum pump—the hydro-turbine. What was the wear and tear at the bends, and had acid-resisting iron been used ?

Mr. Layton said he did not think the chemical dust was

finer than that found in grain generally, and the results were excellent. The electrostatic method had not been tried. Only the fine dust went on to the filters, so that there would be no object in putting in a cyclone in addition to the tubular filters. No trial had been given to the water pump. An ordinary drawn steel pipe lasted probably not less than two years; the wear at the bends was neither difficult nor expensive. In the case of coal special protective measures could be taken. With a square section plates could be bolted on, so that renewal meant merely an extra plate.

Mr. P. Parrish (South Metropolitan Gas Co.) asked if the author had had any experience with spent oxide, as distinct from the ordinary provincial kind. It was fine, and the water content was not large. It seemed suitable for a pneumatic conveyor.

Mr. Layton stated that grain containing 20 per cent. of moisture was dealt with without difficulty. Neither was there difficulty so long as lumps were not too large.

Mr. Reavell desired to know if wood chips, wet and dry, had been dealt with in the conveyor; also wet saturated tannery bark. As to the question of dust, he had been interested in a milk drying plant and the difficulty had been to get a filter that would hold the dried milk. Was there any ratio in the height of the vertical lift compared with the horizontal length? Mr. Layton said there would be no difficulty in conveying dry wood chips, and he thought wet chips could be conveyed. Spanners had been taken up. Milk powder had not been tried on the filters.

Mr. Tungay asked what was the heaviest specific gravity lifted by means of the pneumatic conveyor. It might be that the metal spanners were supported by other material. He supposed a cart of seven-eighth spanners could not be unloaded. (Laughter.)

Mr. Layton said there could be no supporting material for the spanners. Cement was successfully conveyed.

Dr. G. S. Walpole said he entertained the view that the practice would become universal. It was largely followed in Germany and other parts of the Continent. Wet wood chips, common salt and ammonia were handled in this way, also glass sand, but a special material had to be used in regard to the last named at the bends. Cyclones and bag filters were used. The velocity was about 30 ft. per second. This method of handling had spread during the past five years to all the big chemical works, where the material was delivered in crystalline form.

Automatic Weighing Machinery

In the absence of Mr. A. E. Marshall, of Baltimore, U.S.A., who was to have spoken on "The Development and Use of Labour Saving Devices in the American Chemical Industry,"

Mr. S. H. Johnson, of W. & T. Avery, Ltd., Birmingham, read a Paper on "The Developments of Automatic Weighing Machinery and its Application to the Chemical Industry." Up to the present such machines had, he said, been little used in the chemical industry, one reason being the difficulties which chemical products offered to automatic weighing. The war, however, caused rapid developments in automatic weighing machines, and the weighing of materials such as ammonium nitrate, T.N.T., &c. The first basic principle was that an automatic machine should be a proper weighing machine, developed or constructed on lines approved by the Standards Department of the Board of Trade, and the second was the automatic action which consisted of an arrangement of shoots, inlet and outlet valves, suitably controlled by levers, &c., by means of which the material being weighed was caused to flow properly into the weigh hopper, and to be quickly discharged therefrom. The weighing principle of an automatic weigher was a free swinging beam precisely as free as the beam of an ordinary scale, and there were two large classes: (1) The even-armed beam automatic scale, which weighed off pre-determined loads against dead weights; (2) a proportional lever and steelyard machine for automatically weighing and totalising varying weights. The author showed slides illustrating automatic grain weighers in the huge site at the Salford Docks. There were twelve such scales, each with a weighing capacity of 2 tons draught of any kind of grain, and capable of weighing 150 tons per hour each machine. From the automatic weighing of grain evolved the automatic weighing of flour and powdered materials generally. Great difficulty was experienced at the beginning owing to the necessity for the powders to be so controlled that they flowed regularly and freely. The machine had a drive at the top which controls a power-driven feed apparatus. A somewhat similar machine but fitted with a different kind of feed apparatus, with dust cover entirely protecting the flowing of the material, was used extensively in artificial manure works for the weighing of ground phosphate to the mixer before it was treated with sulphuric acid. Such machines were used during the war at the Chilwell shell-filling factory for the purpose of weighing ammonium nitrate, a material which at that date had somewhat the nature of damp snow, and would stick badly. Success was achieved, the feed shoots and weigh hoppers having to be bell-bottomed in order to evacuate the material. Tandem machines were supplied, one weighing 4 cwt. of T.N.T., and the other 16 cwt. of ammonium nitrate.

A powder type of machine without a weigh hopper, for weighing high explosive was next described.

A recent evolution was the automatic liquid weigher, which had a capacity of 1 ton per weighing, and weighed any kind of liquid, however thick, so long as it would flow fairly readily.

Discussion

In answer to Mr. H. C. Reynard (Liverpool), Mr. Jonnson stated that the liquid weigher would weigh to an accuracy of 0·1 per cent. As machines were increased in size the percentage of accuracy decreased somewhat, but with the one ton automatic liquid weighers correction was obtained up to 2 lb. As to the number of tips made by the weigher per hour much depended upon the kind of liquid handled. With a free running liquid a weighing could be made every minute.

Mechanical Handling of Material

Mr. H. Varndell, of Messrs. W. &. C. Pantin, in a Paper on "The Importance of Mechanical Handling of Material in its Relation to Production Costs," said that mechanical precision and transportation, as in other phases of engineering, reduced allowance for error and damage to goods which must always be made when relying largely on the human element. During the early part of the war, it was estimated that the British used 200,000 men for a long time in France handling the freight between the ship side and the various bases near the front. At a later date, patent gravity carriers were used for this work, with the result that about 70 per cent. of these men were released for fighting and other purposes, and the freight was handled in much less time and at far lower cost.

The general principles of the conveying of material in and about factories and warehouses, &c., were based solely on the applying of the machines to minimise the amount of rough labour and to assist skilled labour. The expert in freight handling first considered whether the operation of transferring material could be done through the force of gravity, as this was obviously the method necessitating the lowest operating costs and in most cases less initial expense. The force of gravity could only be applied of course, when the material was required to be taken from a given point to somewhere in a lower horizontal plane. When this condition existed and other factors permitted, the well-known types of conveyors, such as patent gravity carriers, spiral chutes and lowerators were most generally used.

In construction and operation the patent gravity carrier was the essence of simplicity. It was generally made in standard lengths of 8 ft. with coupling hooks for joining up length to length to cover the required distance. In construction it consisted merely of two parallel side frames with rollers fitted across on spindles at regular intervals. The rollers were steel tubes of 14 gauge and 2¼ in. diameter, and were fitted with ball bearings at each end made out of steel stampings. Boxes, crates, cartons, &c., were merely placed on the carrier and allowed to move forward by gravity, the carrier being set at a sufficient gradient according to the speed at which the goods were to travel. For general purposes this gradient varied from 3 to 5 per cent. All that was necessary when the conveyor was required for use was to connect up the 8 ft. lengths until the conveyor was suitably long, resting on any old boxes available, or in the case of a permanent installation, on graduated supports. After use it was the work of only a few minutes to disconnect the lengths and take them away to their place of storage, or to another point where they might be required for use. To raise goods from one floor to another,

or through a series of floors, power driven machines, on the continuous chain principle, were mostly employed. In many of the most modern firms, the machines performing the various processes in producing a finished article from raw material were actually fed by suitable types of carriers, thus eliminating the carrying by hand of material from one machine to another.

Discussion

Mr. S. H. Blichfeldt said the Maypole Co. had a large gravity carrier installation which worked admirably. The usual things carried were 56 lb. boxes. The carriers were easily put up, and maintenance costs were not great. Elevators cost more.

Automatic Filling Machines for Liquids

Mr. H. F. Broadhurst, of Alison Broadhurst Machine Co., in a Paper on this subject, said that filling thick liquids into tins had always been difficult and slow, because they would not run clean out of a measure. Filling, for instance, heavy oils or varnishes into narrow-necked tins meant drawing off into a measure, pouring from the measure into a funnel, and waiting for the measure and funnel to drain, and then the amount poured into the tin was only approximately correct, and there was a lot of drip and waste. For filling open-necked tins, such as the standard levertop, by weight, the usual method was with a jug and a pair of scales. This resulted in over-filling—as much as 5 per cent. of the material being given away—and considerable waste, and the average speed about four tins per minute. These methods were only possible when paying a very low rate of wages; now the filling machine was a necessity. Such a machine would fill at more than six times the rate of hand-filling with absolute accuracy, and so cleanly that in addition to other advantages the whole cost of cleaning tins was saved.

There had been a number of attempts at machines, and many manufacturers had made trials with machines of their own. Practically they all worked on the principle of a filling valve, a pair of scales, and a connection from the scale beam to some form of trip motion above the valve to allow it to close when the scale moved. The difficulty of this system was that when the scale began to move it was balanced, and had no power to operate the lightest trip motion until sufficient extra weight was put in to overcome the friction of the trip. If this were a constant error it would be all right, but it was not by any means. The friction varied, and this system would not fill 1 lb. tins within several ounces of the correct weight.

The next development was of a similar sort of arrangement, but the trip motion was replaced by an electrical solenoid, which either opened or closed the valve, or might do both, and contact was made by an electrical connection at the end of the beam dipping into a mercury cup. This would work accurately, but it presented a number of difficulties, one of which was the delicacy of the contact; another the oxidisation of the mercury; another the complication of having to put delicate electrical gear into a factory for the use of unskilled operators who never understood the machine.

The latest development which overcame all the above difficulties was the bent-up weighing lever. In this case the weighing lever was not horizontal, and as soon as it moved the weights moved inwards, so that their leverage decreased as the scale fell, and the centre of gravity of the tin being well above the knife edges, it fell outwards and increased the leverage. This scale, as soon as it moved off its support, fell with an increasing speed and force, the load became heavier, and the weights lighter, and after a very short and quick travel ample power was available to operate any sort of trip gear. This motion, which was patented in most countries for this purpose, was the basis of a satisfactory mechanical cut-off. This cut-off used with this scale was a valve-lifting lever and a horizontal pawl which had a notch to keep it in the valve-open position. A trip arm attached to the scale-centres worked under this pawl, which for three-quarters of the scale travel did not touch, but during the last quarter, when the scale was moving with considerable force, this arm came under the pawl and raised it, allowing the valve to close by its own weight and giving a very sharp cut-off.

Discussion

In reply to Mr. Reynard, Mr. Broadhurst stated that accuracy could be obtained within the fraction of an ounce in the filling of a 56 lb. tin. Where there was sediment in the liquid the contents could be stirred by a mechanical agitator. On the ordinary lever top machine 2 lb. tins could be filled at the rate of 25 per minute.

Votes of Thanks

This concluded the Conference, and at the suggestion of Mr. Talbot thanks were accorded to Mr. F. R. O'Shaughnessy, the hon. secretary of the Birmingham and Midland Section of the Society of Chemical Industry, for acting as hon. local organiser. The success of the arrangements was largely due to him.

Mr. O'Shaughnessy replied that he was glad to have had the opportunity of contributing to the success of the Conference.

Acknowledgments were also made to contributors of Papers.

A vote of thanks was accorded to the chairman, and Mr. Smith, in reply, said he had congratulated himself upon making the acquaintance of so many distinguished gentlemen in the scientific world. He believed science held the key to the solution of nearly all the problems that confront us.

A number of members paid a visit to the B.S.A. Works on Saturday morning.

Mr. Talbot posted a notice stating that the fourth Conference of the Chemical Engineering Group will be held on Monday and Tuesday, July 13 and 14 (on the occasion of the annual meeting of the Society of Chemical Industry at Newcastle-on-Tyne), when the subject for discussion would be "Filtration." It is hoped to arrange for the demonstration to the Conference of the only examples at work in the U.K. of two modern types of centrifugal filter, continuous and intermittent in action under works conditions.

United Alkali Co.

THE adjourned twenty-seventh and twenty-eighth ordinary general meetings of shareholders in the United Alkali Co., Ltd., and also the twenty-ninth ordinary general meeting were held at Liverpool last week, Mr. Max Muspratt (the chairman) presiding.

The Chairman, in moving the adoption of the report for 1919, said the transference of the company's operations from a war to a peace basis had taken much longer than was anticipated, and it would be well on in the present year before they would be completely at work on the new processes in the most up-to-date plants, whilst their enormous programme of deferred repairs could scarcely be completed for some time to come. Manufacture was carried on under adverse conditions and costs were extremely high. The company's relations with its workmen continued cordial, and after a lassitude on the part of the men which was at first visible after the strain of war, a steady improvement was shown. Though the present idea of a reasonable day's work militated strongly against the increased production so essential for the rehabilitation of the world, they realised the necessity of patience, and had confidence in the ultimate common sense of their men, whom they looked upon as partners and tried to treat as such. The increase in manufacturing costs, however, was a serious matter, as two items would show. Labour, which cost £750,000 per annum before the war, cost last year over £1,750,000, and fuel, of which they used some 800,000 tons, cost 27s. per ton, against 11s. in 1915. Supplies were frequently inadequate, causing temporary stoppage and loss of output. A scientific industry such as theirs could not be indifferent to the educational needs of the district, and in connection with the appeal for funds for the University of Liverpool they had decided to make a donation of £10,000, spread over five years. In the course of the year, and in accordance with a policy of concentration, they had closed and dismantled the Gerard's Bridge works at St. Helens and the Muspratt works at Flint, and had sold the latter to Courtauld's, Ltd., on not unfavourable terms. During the war it was practically impossible to visit personally the foreign markets or their overseas properties, but during the last twelve months Mr. J. E. Davidson had visited Scandinavia, Mr. Bewick the Near East and the Far East, Mr. Rayner, Spain, and, in conjunction with Dr. Clayton, the United States. Mr. Short had just returned from Tunis as a representative of the Fertiliser Association, and would visit America in June in the same capacity. Mr. Rayner and he (the chairman) proposed to visit Spain at the end of the month.

The meeting approved the payment of dividends of 7 per cent. on the preference shares and 3s. per cent. on the ordinary shares.

Fixation of Nitrogen from the Air

An Account of the Claude Process and Its Installation in England

In view of the world-wide interest that is being taken in the fixation of atmospheric nitrogen respecting the best and cheapest means of making nitrogen from the air available for agricultural and other purposes, Cumberland Coal Power and Chemicals Ltd., of 5 and 6, Great Winchester Street, London, E.C., feel that the time has arrived when they should place before the public the following information.

It is well known that Germany, after having tried a variety of methods for atmospheric nitrogen fixation, has developed and installed works on a gigantic scale for the production of synthetic ammonia for both agricultural, chemical, and war purposes.

There can be no doubt synthetic ammonia is the best all-round method for the fixation of atmospheric nitrogen.

Synthetic ammonia is manufactured by combining hydrogen and nitrogen gases under compression.

(*a*) The nitrogen is obtained from the atmosphere by compression.

(*b*) The hydrogen has hitherto been produced from blue-water gas, which is made from coke.

Cumberland Coal Power and Chemicals, Ltd., have secured from the French owners the "Claude" new improved process for the production of synthetic ammonia, and have the sole and exclusive rights for Great Britain and Ireland, South Africa, the Commonwealth of Australia, New Zealand, and India.

Comparison of French and German Processes

The improved synthetic ammonia process, which has been developed by M. Georges Claude, differs essentially from the development given to the original Haber process by the Badische Anilin ü Soda Fabrik at Oppau, near Ludwigshaven, by aiming at increasing, instead of diminishing, the pressure at which the mixture of nitrogen and hydrogen are constrained to enter into combination to produce ammonia. Both in Germany and the United States the tendency has been to endeavour to bring about their combination at lower pressures rather than at higher pressures. The German original working pressure was some 300 atmospheres, and this has been reduced in present practice to some 200 atmospheres, while in the United States the Degendre or General Chemical Company's modified Haber process has further reduced the pressure of combination to about 150 atmospheres. The relatively high temperature at which the process was originally worked has, however, remained unaltered at about 600 deg. C. both in Germany and France, so as to maintain the rate of combination unimpared.

The French process, which is based upon original patents obtained by M. Georges Claude, entirely independent of those upon which the Badische Company rely, increases the pressure of combination to 1,000 atmospheres (14,000 lb. to the square inch), without reducing the temperature at which the combination is effected.

This pressure is reached in three main stages, viz.: 100 (by the aid of ordinary compressors), and then is at once brought to 300 and 1,000 atmospheres by special compressors, so constructed that at the higher pressure they work freely and with as little wear and tear as they would work at a quarter of that pressure. The rationale of the improved yield at increased pressure of combination depends upon the well-known reluctance evinced by nitrogen to enter into chemical combination with other elements, unless forced into intimate contact therewith. This reluctance is accentuated where the nitrogen is dealt with in mass and at comparatively low temperatures. By thus increasing the pressure of reaction to 1,000 atmospheres, the yield of ammonia is increased four-fold up to 50 per cent., while the speed of reaction is commensurately increased. The power required to compress to 1,000 atmospheres is admittedly greater than to 200 atmospheres, but there are some essential advantages secured which, in the final result, makes the total power expended per ton of synthetic ammonia produced no larger than what is required for compression at 200 atmospheres.

Further Advantages

1. In the French process compression is effected in a single operation at 1,000 atmospheres, instead of a lengthy chain of operations in the German process at 200 atmospheres, where that pressure has constantly to be maintained and restored.

2. In the French process the spontaneous condensation of the ammonia formed in the circulating mass is effected by ordinary cooling water at ordinary pressures, whereas the German method makes the use of injected water at high pressure (200 atmospheres) compulsory, to ensure the re-entry of the uncondensed gases into the circulating mass at that pressure—as well as to make good the loss of pressure in the ammonia towers.

3. The condensation of the ammonia in the French process is effected in a liquefied non-gaseous condition, which provides a valuable source of refrigeration for the succeeding process of the fixation of the ammonia in a form suitable for agricultural use.

4. The evaporation of the ammonia to a gaseous form, which in the original German process constituted an additional source of expense, becomes entirely unnecessary with the French process, as the ammonia being in a liquid form, it passes of itself to the gaseous state by the action of ordinary water cooling, and without distillation.

Chloride of Ammonia

M. Georges Claude, to whom the French improved process is due, has from the outset appreciated the fact that the commercial success of the cheap production of synthetic ammonia necessarily depends upon its increased employment in agriculture. This in its turn depended upon its being linked up with a less expensive and more satisfactory method of fixing the ammonia for fertiliser purposes than can be secured by the manufacture of sulphate of ammonia, which necessitates the employment of sulphuric acid in large quantities.

M. Georges Claude has devised a modification of the classical solvay ammonium soda process for the production of chloride ot ammonia and bi-carbonate of soda consisting of decomposing large quantities of sodium chloride (brine) with the aid of ammonia and carbonic acid gas. This results in the separation and precipitation on one side of ammonium chloride and on the other of sodium bi-carbonate, utilising the alternate percipitation method due to Schreib, by means of which for each ton of fixed nitrogen in the form of ammonia three tons of bi-carbonate of soda are recovered. The process may be briefly summarised as follows: Taking as the basis of operations a saturated solution of ammonia and salt and adding carbonic acid gas, bi-carbonate of soda and chloride of ammonia are formed, then by adding further ammonia and carbonic acid gas neutral carbonate of ammonia is obtained adn chloride of ammonia is precipitated. The remaining carbonate of ammonia in solution, through the addition of further carbonic acid gas, is then transformed into bi-carbonate of ammonia, which in the presence of chloride of ammonia causes the precipitation of the bi carbonate of soda, and a adding carbonci acid gas, bi-carbonate of soda and chloride of ammonia are formed, then by adding further ammonia and carbonic acid gas neutral carbonate of ammonia is obtained and chloride of ammonia is precipitated. The remaining carbonate of ammonia in solution through the addition of further carbonic acid gas, is then transformed into bi-carbonate of ammonia, which in the presence of chloride of ammonia causes the precipitatin of the bi-carbonate of soda, and a solution of chloride of ammonia is once more reconstituted. On the addition of more salt and carbonic acid gas the same cycle of operations is started over again in the same solution indefinitely. After having twice operated as above chloride of ammonia is still produced of 97 per cent. purity.

The fertiliser value of ammonium chloride has been thoroughly investigated and found to be equal to that of sulphate of ammonia, and as the chloride is less weighty than the sulphate for the same fixed nitrogen contents it is less expensive to transport.

The basis of the chloride used in conjunction with the synthetic ammonia is simply salt obtained from rock salt or distilled from salt water and purified.

In addition to the improved method outlined above of

fixing the synthetic ammonia for agricultural purposes as a chloride instead of a sulphate, M. Claude has perfected a method for the production of hydrogen from producer gas, which gives better results as to purity and cost than the iron contact process, the Linde-Frank Caro or the Badische Anilin Catalytic process (the second of these, which was used at first starting at Oppau, was replaced by the Catalytic processes developed by the Proprietary Company). This new French method of producing hydrogen forms an integral part of his synthetic ammonia process developed at Montereau in the Grand Paroisse Company's works.

Not the least of the advantages of the Claude synthetic ammonia process over the original German Haber process is that the required plant is both simplified and cheapened as compared with the German process by at least 25 per cent. all round. The cost per unit of ammonia will be also diminished to a sensible extent, as well as that of the agricultural product, which is the ultimate form in which the ammonia will reach the consumer—chloride of ammonia being considerably cheaper than sulphate of ammonia has ever been because salt is cheaper than sulphuric acid, and because in the manufacture of sulphate there is no by-product such as bicarbonate of soda, having a commercial value and a ready sale, to place on the credit side of the balance-sheet.

One of the best testimonials to the merit of the French improved synthetic ammonia process is afforded by the fact that the working capital required for the chemical manufacturing company of La Grande Paroisse incorporated to work the patents in France and her colonies has been subscribed by the St. Gobain Company, one of the most powerful and strictly conservative undertakings in France.

Hydrogen Production

The most important and expensive part of the process is the production of the necessary hydrogen, which has hitherto been obtained from blue water gas, which is made from coke There is 55 per cent. of hydrogen in the Cumberland coke oven gases, and by M. Claude's new hydrogen process it is quite simple to obtain this hydrogen from the coke oven gases, leaving the remaining gases available for power purposes. The importance of this fact cannot be too strongly emphasised, as it means reducing the cost of hydrogen by at least one-half of that of any previously known method, and with the 200 coke ovens, there will be ample hydrogen available in the gases to produce sufficient synthetic ammonia to permit of the manufacture of 50,000 tons of sulphate of ammonia per annum, thus obviating the necessity of using any coke whatever for this purpose; consequently the whole of the coke produced will be available for sale.

According to information gathered from published sources the cost of sulphate of ammonia manufactured in the Badischec Anilin ü Soda Fabrik's works at Oppau by the Haber process in 1913, inclusive of full depreciation and interest on the cost of the works, was about £7 a ton of sulphate of ammonia. This was reduced when the works attained their full output to some £5 a ton.

It is practically certain that the cost of production of sulphate of ammonia by the French process will be considerably lower than that of the German Haber process, while the production of chloride of ammonia for agricultural purposes will ensure still greater economical advantages as compared with sulphate of ammonia.

Importance of Coal Supply

In order successfully to produce synthetic ammonia on a large commercial scale considerable quantities of coal are required, and it is essential that the manufacturing company should own its own coal mines and coke oven plates, and that the works should be situated adjoining the collieries.

After careful examination and study of coalfields in various parts of England, the conclusion arrived at is that West Cumberland offers the greatest advantages for such an undertaking. Cumberland Coal Power and Chemicals, Ltd., own the share capital of the Oughterside Coal Co., Ltd., whose colliery, coke oven, and by-product works are situated at Bullgill, Cumberland, and are also purchasing the issued ordinary share capital of the Allerdale Coal Company, Ltd., and the Moresby Coal Co., Ltd., whose respective collieries, coke oven, and by-product plants are situated at Great Clifton and Moresby, Cumberland. All these collieries are fully equipped and going concerns, with an area of about 11,000 acres of coal land, in which our engineers estimate there is over 100,000,000 tons of workable coal. The collieries have a capacity of about 2,400 tons of coal per day.

Four hundred and eighty acres of freehold land is being acquired adjoining the coke oven plant at the Allerdale Colliery, which site will be utilised for large synthetic ammonia works. The company has also acquired control of about 20,000 acres of coal land, commencing at Maryport (Cumberland), running in a north easterly direction.

A New English Company

As soon as the full size commercial unit is in successfu operation in France, an English company, to be known as "Atmosphere Nitrogen and Ammonia Products, Ltd," will be formed with a capital of £2,500,000, and it is proposed that this new company shall acquire from the shareholders the whole of the share capital of Cumberland Coal Power and Chemicals, Ltd., and erect a synthetic ammonia plant, &c., on freehold land adjoining the Allerdale coke oven plant at Great Clifton, Cumberland.

The site is particularly well situated for such works, being connected by rail with and situated within two miles of the port of Workington, which can accommodate boats up to 5,000 tons capacity. It is understood that the owners of this port contemplate increasing the facilities of same so as to berth boats of about 10,000 tons. The great advantage of this port for the export of the proposed company's products cannot be overestimated.

The first unit of the synthetic ammonia plant to be installed will be of sufficient size to permit of the production of 50,000 tons of sulphate of ammonia per annum.

Whilst there is every confidence in the merits of chloride of ammonia for agricultural purposes, it is not yet an established fertiliser in the British market. Therefore in the first instance it is considered advisable to utilise the synthetic ammonia produced for the manufacture of sulphate of ammonia, which is a well-known fertiliser commanding a ready market at a highly remunerative price.

It is estimated that, after disposing of the annual production of 50,000 tons of sulphate of ammonia at a considerably lower figure than to-day's ruling prices, there should be realised a net profit of at least £500,000 per annum.

A small plant will also be erected for the production of chloride of ammonia, and this product will be introduced and popularised in the various fertiliser markets, which will be followed by the installation of large units so soon as this fertiliser has acquired, in the consumer's estimation, the reputation to which it is rightfully entitled, and as this valuable manurial product can be placed on the market at a lower price than sulphate of ammonia, there is little doubt that it will secure a practically unlimited demand.

Synthetic ammonia manufactured under the favourable circumstances as to cost provided by this scheme, will ultimately ensure to the farmer a nitrogeneous manure, produced in this country, fully as efficient as Chili nitrate, at a much lower cost, and thus render him wholly independent of importation. It should be noted that the scheme, if increased to the scale which it could easily attain at a future date, would provide for all the British requirements of nitrogenous manures, and enable the farmer to fertilise intensively and scientifically cultivate additional land. Farming, which has been and should be the premier industry of the country, would then be able to resume its proper position, and millions of acres now unproductive could be made remunerative, and land at present cultivated could be made to yield a maximum return. With this cheap source of nitrogen at our disposal our enormous reserves of waste land could then produce corn, and render the nation self-supporting for its cereals.

It is also contended that the successful carrying out of this scheme to the fullest extent will make this country absolutely independent of the importation of Chili nitrate, both in peace and war, as the whole of the nitric acid, nitrate of ammonia, cyanides, and various other ammonia compounds, &c., required for commercial and military purposes will be produced in this country from synthetic ammonia at a lower price than they could be produced at from the imported Chili product.

A Correction

To the Editor of THE CHEMICAL AGE

SIR,—I notice in your last number, April 24, an account of the Chemical Engineering Group's annual dinner, &c., in which you report Dr. Ormandy as having said that "the Manchester Section of the Society had seen fit to hold an exhibition of chemical engineering apparatus in Liverpool, &c." Whilst I cannot believe that Dr. Ormandy made such an absurdly inaccurate statement I must ask you to publish a correction. The Manchester Section has not held an exhibition of chemical engineering apparatus either in Manchester or in Liverpool, and the meetings held in the latter city are, of course, those of the Liverpool Section.—I am, &c.,

Manchester, April 26. L. GUY RADCLIFFE.

The Use of the Term "Chemist"

To the Editor of THE CHEMICAL AGE

SIR,—The movement which is on foot for the restriction of the use of the word "chemist" to those who are really entitled to use it, might be somewhat assisted by chemical journals using the word in its proper significance.

On p. 441 of your issue for April 24, under the heading "recent wills," two men are described as "chemists." They may be so, but they may be druggists or pharmacists. If this be the case do you not think they should be so described? If chemical journals set an example in the proper use of the word "chemist," other journals might follow suit.—Yours, &c.

CONSISTENT.

[The descriptions given in these cases are the official descriptions for the purposes of Probate, and it hardly falls within our province to correct them, even if we had the necessary information.—ED., *C. A.*]

Chemists' Salaries in Glasgow

To the Editor of THE CHEMICAL AGE

SIR,—In reading through the last issue of your excellent journal my attention was arrested by the small paragraph on salaries of industrial chemists in Glasgow.

It is truly a scandalous state of affairs that at the present period a chemist in charge of a works should receive a "salary" of only £2 10s. per week, and any employer paying that sum is putting a premium on inefficiency and creating a menace to the public consuming his goods. This needs no emphasising in view of a recent report of a coroner's inquest.

The paying of inadequate salaries is, unfortunately, not confined to Glasgow; but the chemist has the remedy in his own hands by combining to secure that remuneration to which, by reason of his education and training, he is justly entitled.

The British Association of Chemists has, I am given to understand, already taken this particular case in hand; but the chemist should take a lesson from "labour," and join this Association, formed to protect his own interests, and turn from the disastrous policy of "sitting on the fence."—Yours, &c.

Goodmayes, April 27. "CHEMICO."

Chemists and Income Tax

To the Editor of THE CHEMICAL AGE

SIR,—It may interest other chemists beside the members of the National Association of Industrial Chemists to know that we have received the following statement from the Inland Revenue Office:—

"It is open to any individual member to appeal to the body of Income Tax Commissioners for his district if he considers that an expenditure on clothing, scientific books, &c., is necessarily incurred in the course of his employment."

Unless such expenditure "is necessarily incurred in the course of employment," no such allowance can be deducted for income tax purposes.

The Inland Revenue authorities are notoriously reluctant to grant concessions, but I am informed that several of our members have obtained deductions for clothing and scientific books in accordance with the above statement, and I hope that other chemists may be equally fortunate. Everything depends, however, on the good will of the local Commissioners and on the ability of the chemist to show that the expenditure is a necessary result of the employment.—I am, &c.,

National Association of Industrial Chemists, April 27. A. B. SEARLE, *Hon. Secretary.*

Death of Mr. William B. Cowie

THE death occurred under distressing circumstances on Monday night of Mr. William Beaverly Cowie, wholesale manufacturing and analytical chemist, 26, Clyde Street, Edinburgh, aged 54 years. Accompanied by his son he went to close his premises for the night and found two sailors near the entrance. One of these struck him and cut him severely over the eye. Both sailors were arrested, and Mr. Cowie, after his injuries had been attended to at the Royal Infirmary, was able to return home. He collapsed, however, while preparing to retire and died almost immediately.

Mr. Cowie served as an apprentice chemist with Provost Alexander, Banff, to which town he belonged, and passed his minor examination in 1889 and the major in 1891. He was employed in the laboratories of Messrs. T. & H. Smith & Co., Edinburgh, from 1889 till 1895, and in the latter year he founded the Edinburgh Central School of Pharmacy and prepared many students for the minor and major examinations. Owing to the increasing demands made upon his time by his wholesale manufacturing business and to his growing practice as an analytical chemist, he relinquished teaching some years ago.

Mr. Cowie was a distinguished student at the Heriot Watt College, Edinburgh, and was keenly interested in everything relating to science and education. He was a past president of the Edinburgh Chemists' Assistants and Apprentices' Association, a fellow of the Chemical Society, a member of the Society of Public Analysts and of the Society of Chemical Industry, a life member of the Pharmaceutical Society since 1892 and had been a member of the North British Branch of that Society from 1899 till his death. He was also an honorary member of the Pharmaceutical Society of Sweden and a fellow of the Botanical Society of Edinburgh. A man of strong personality and untiring energy, he was well known throughout Scotland as an active worker in all matters relating to pharmacy on its professional and business sides. He frequently contributed Papers at the scientific meetings of the Pharmaceutical Society in Edinburgh and at the British Pharmaceutical Conferences. He will be greatly missed by his colleagues and friends, by whom he was held in high respect, and the sincere sympathy of all will go out to his widow, son and daughter in their loss.

Chemical Views on the Gretna Report

THE *Yorkshire Post*, which is in the centre of the British dye industry, states that in the chemical and dye industries the Report just issued on the future of Gretna (referred to in our Editorial Notes) great interest is taken in the recommendation that a portion of the Gretna ether plant should be adapted to commercial requirements. Professor A. G. Perkin, professor in colour chemistry and dyeing in the University of Leeds, is reported as having welcomed the proposals of the Committee, and expressed the view that dye makers in this country will approve of the scheme if they can be assured of steady supplies of methyl-alcohol at a reasonable price. As it appears that the existing plant at Gretna can be utilised with slight modifications, Professor Perkin considers that there should be a prospect of the process being an economical one. "In view of the attention that is being given to the development of the British dye industry, it is essential," he observed, "that we should have a large factory of this sort in this country, instead of being dependent upon other countries for our supplies. If methyl-alcohol of a high grade can be made in great quantities, and at a moderate price, it should be of the greatest value to the dye industry, and under the scheme outlined by the Committee the medicinal photographic and chemical industries would also be helped."

Fire Dangers in Factories

OWING to the pressure on our space this week the second instalment of Mr. T. H. Gant's Paper on "Fire Dangers in Factories and their Causes," is unavoidably held over.

Distillation Plant

A Paper by M. Stephane Masfaraud

THE ninth meeting of the session for the Manchester Section was held at the College of Technology, on Friday, April 23, Mr. John Allan presiding. There was an attendance of nearly 250 members, and a paper on "Distillation Plant" was contributed by M. Stèphane Masfaraud.

The paper had special reference to the rectification of alcohol, acetaldehyde and other volatile products and continuous ether manufacturing plant, and M. Masfaraud said that the chief problem which presented itself for the present as well as the future for the development of chemical industries was the economical purification of the products needed by traders. When fixed substances were treated pure products could be obtained without much difficulty by the judicious use of the reagents and solvents followed by successive crystallisation or dialysis. But when volatile matters were present the best process of purification and separation of the elements contained in raw materials was found in fractional distillation or rectification. Very great industries were based on distillation, such as the production of ethyl alcohol and brandy, methyl alcohol and superior alcohols, ether and the various esters, chloroform, acetone, perfumes, petroleum, benzols, turpentines, oxygen, nitrogen, &c. Also the recovery of volatile solvents, a matter of increasing importance, depended upon distillation.

Distillation of Binary Mixtures of Non-miscible Liquids

How was it that if a mixture of water and turpentine essence was boiled in the same still—the turpentine boiling at nearly 160°C.—the essence passed in greater quantity than water, and at a boiling point lower than 100°C., lower than that of the more volatile element? How, again, did it happen that water vapour carried off mercury under 100°C.? Also the mixture of Dutch liquid, Di-ethylene chloride (CH^2Cl—CH^2Cl) and water had a fixed boiling point on the same atmospheric pressure, *i.e.*, 75·6°C. inferior to that of water (100°C.) and pure Dutch liquid (82·4°C.).

The facts observed must of necessity happen; the two insoluble bodies being incapable of any reciprocal reaction it was evident that the resulting tension P was equal to the sum of the tension $F \div F^1$ of the two liquids at the boiling temperature T of the mixture. Therefore F and F^1 must be inferior to P, and the result was that the boiling temperature T was inferior to that of the two liquids when pure under pressure P. The composition of the distilled liquid could thus be forecasted. If denoted by A and B the respective weights of the two liquids simultaneously volatilised and by D and D^1, the densities of their vapours, there was the following ratio :—

$$\frac{A}{B}=\frac{D}{D^1}\times\frac{F}{F^1},$$

and as the densities D and D^1 were proportional to the molecular weight M and M^1, the ratio became

$$\frac{A}{B}=\frac{M\,F}{M^1F^1}\text{, in which } F \div F^1=P.$$

This statement summed up the distillation of a binary mixture of non-miscible liquids.

Distillation of Binary Mixtures of Miscible Liquids

When the liquids were soluble one in another, the simple laws which had been established for the mixtures of insoluble liquids could not be applied. Therefore, the laws which governed the distillation of the mixtures of two miscible liquids were complex, and for a long time the distillation was purely empirical. Regnault divided a miscible mixture into two classes. The first class included substances which dissolved more or less, but of which such quantities were used that, after reciprocal saturation, there remained two separate liquids. The second class was made up of binary mixtures of substances which dissolved in all proportions and always resolved into a single liquid. The tension of the mixture water and ether, which belonged to the first class, was nearly equal to that of pure ether. Mixtures of the second class, for example, ethyl alcohol and water, ethyl and alcohol and ether carbon sulphide and carbon chloride, showed that the ratio of the vapour pressure of the mixture to the sum of the vapour pressure of the two bodies was constant whatever might be the temperature.

Distillation of the Mixture Water and Ethyl Alcohol

Duclaux had established the relation

$$\frac{da}{de}=M\frac{a}{a \div e}\text{ in which}$$

a represents the alcohol per cent. in volume in the original liquid,
b represents the water per cent. in volume in the original liquid,
da represents the alcohol per cent. in the vapours,
de represents the water per cent. in the vapours.

The relation is represented by a hyperbola, of which the equation was

$$\frac{Y}{100-ya}=M\times\begin{matrix}Y=da\\ X=\dfrac{a}{a \div ex}.\end{matrix}$$

For the mixture of water and ethyl alcohol of strength below 25 per cent. by volume of the latter, $M=15{\cdot}4$; for the mixture of water and methyl alcohol of strength less than 30 per cent. of the latter, $M=10{\cdot}9$. The result is that the ethyl alcohol vapourised more quickly than ethyl alcohol. This fact was, moreover, accentuated in the higher series.

M. Masfaraud gave the following examples :—

Water and propyl alcohol up to $a=10$ per cent. $M=20{\cdot}9$.
Water and butyl alcohol up to $a=4$ per cent., $M=41{\cdot}5$.
Water and amyl alcohol up to $a=1{\cdot}6$ per cent., $M=49{\cdot}6$.

By determining a coefficient C so that richness of vapour = richness of liquid XC or $da=ca$, the coefficient showed clearly the tendency of the phenomenon.

The following were some values of C as taken from Sorel :—

$a=1$	$C=9{\cdot}9$	$-a=5$	$C=7{\cdot}15$
$a=20$	$C=3{\cdot}31$	$-a=40$	$C=1{\cdot}8$
$a=60$	$C=1{\cdot}3$	$-a=80$	$C=1{\cdot}08$
$a=95$	$C=1{\cdot}003$	$-a=97$	$C=1{\cdot}001$

From 97 per cent. to 100 per cent. C was very nearly equal to 1.

When one of the substances under distillation existed only in quantities extremely small it was very firmly held back by the substance existing in quantity. To solve problems relating to the distillation of mixtures of miscible liquids it was necessary in the series of experiments to determine the tensions of several mixtures of two of these liquids, then introduce the third body, and again determine the tensions.

Sorel studied a special case presented by alcoholic liquids in industry. In these liquids two bodies dominate, water and alcohol, and the third was an impurity existing only in slight quantity. To call S the weight of the third body contained in a kilogramme of mixed vapours p—the weight contained in a kilogramme of the generating liquid—there was a ratio of the form :—

$$S=Kp \div K^1p^2 \div K''p^3 \div K'''\div p^4 \div \quad . \quad . \quad . \quad .$$

but p being very small by hypothesis, p_2 p^3 p^4 may be neglected, and thus $S=Kp$.

Sorel, from an experimental data obtained, calculated the values of K for different alcoholic concentrations for different substances while maintaining p below 0·02.

Some Values of K for Amyl Alcohol in Diluted Ethyl Alcohol

Percentage by volume of ethyl alcohol.		Value of K for amyl alcohol.
25	.....	5·5
30	.....	3·0
40	.....	1·92
50	.....	1·20
60	.....	0·80
70	.....	0·54
80	.....	0·34
90	.....	0·30
95	.....	0·25

The boiling point of amyl alcohol was 132°.

Sorel named the coefficient K as the coefficient of solubility.

Barbet substituted for Sorel's coefficient of solubility one of much greater interest and utility, and this he termed the coefficient of purification. M. Masfaraud then explained Barbet's argument and demonstrated the advantage of his coefficient. What was of main interest was the ratio of impurity of the vapourised alcohol to the impurity of the

alcohol in the liquid under distillation. This ratio was not given by the coefficient K. Thus if alcohol were taken at 25 per cent. by volume containing a 1/160th part of amyl alcohol in relation to ethyl alcohol alone, that was O cm^3, 25 per cent. of the liquid being distilled. According to Sorel $K=5{\cdot}5$, that is to say that the vapour eliminated carried with it $0{\cdot}25\times5{\cdot}5=1{\cdot}375 cm^3$ of amyl alcohol. But the vapour was richer in alcohol than the liquid under distillation. According to Sorel it was at a concentration of 67·95 per cent. by volume. The impurity of the vapours, that is the proportion of amyl alcohol in relation to ethyl alcohol, would be $1{\cdot}375\times\frac{100}{67{\cdot}95}=2{\cdot}02$. The coefficient of purification that Barbet designated by K^1 was thus 2·02. This coefficient gave in a far more exact and accurate manner the progress of purification for the product under consideration.

Percentage by volume of ethyl alcohol.		Barbet's value of K^1 for amyl alcohol.
25	.....	2·02
30	.....	1·30
40	.....	1·05
50	.....	0·80
60	.....	0·615
70	.....	0·44
80	.....	0·36
90	.....	0·26
95	.....	0·22

Barbet had established a graph which gave the different values of K^1 for the various impurities studied. He traced a line of abcissæ to the point $K^1=1$. The line of ordinates is divided into regular intervals: $K^1=2$, $K^1=3$, &c. Above and below the origin in intervals of the same length $K=\frac{1}{2}$, $K^1=\frac{1}{3}$. Barbet rightly remarked that it would be incorrect to ascribe only one division between $K^1=1$, and $K^1=0$. In fact the aim is to represent the relative proportion of impurity that exists in the liquid under distillation and in the evolved vapour. The purification changes sign at the point $K^1=1$. So long as $K^1<1$, the vapours contain more impurity than the liquid under distillation. When $K^1=1$ the two degrees of concentration are identical. Lastly, when $K^1<1$ the impurity concentrated in the liquid.

The lecturer expressed his indebtedness to MM. Barbet, Paris, for permission to show the lantern slides used during the lecture, and added that M. E. Barbet was the inventor of the first type of alcohol rectification apparatus. During the past 30 years the firm of Barbet had designed and installed numerous plants for the distillation of all kinds of volatile products. Between November, 1914, and November, 1918, MM. Barbet built up apparatus of the following capacities per 24 hours :—

In alcohol...	...	917,800 litres at 96·97 per cent.
In ether ...	...	913,000 litres.
Petroleum	...	480,800.

several tons of acetone, sulphobenzol, chlorobenzol, recovered mixtures of alcohol and ether, &c., and all the ether plant plant required by the British Government for munition purposes.

Mr. Edward Whitley, M.A., Trinity College, has offered to the University of Oxford a sum of £10,000 towards the endowment of a PROFESSORSHIP OF BIO-CHEMISTRY on certain specified conditions. In convocation on Tuesday next a decree will be proposed gratefully accepting the offer and decreeing the establishment of the professorship. It is proposed that the professor shall also receive from the University Chest annually such a sum as, together with the annual income from any further endowment which may have been proved from other sources and the annual emoluments of any fellowship of a college to which he may have been elected as professor, will amount to £400. The first appointment of a professor, it is provided, shall be made by Mr. Whitley, but shall be subject to the unanimous approval of the Vice-Chancellor, the Regius Professor of Medicine, the Wayneflete Professor of Physiology, The Wayneflete Professor of Chemistry, and the Professor of Pharmacology. In the same Convocation a decree will be proposed expressing thanks to the British Dyestuffs Corporation, Ltd., for their munificent donation of £5,000 towards the cost of extending the organic chemical laboratory.

Catalytic Hydrogenation

THE annual meeting of the Liverpool Section of the Society of Chemical Industry was held on April 23, at the Royal Institution. In a Paper, by Dr. Armstrong and Dr. T. P. Hilditch, entitled "Further Contributions to the Theory of Catalytic Hydrogenation," it was stated that the mechanism of the catalytic hydrogenation of fats had been studied by several workers with the result that varying explanations of the chemical nature of the process had been put forward. Most of these were on the basis of a "logarithmic" course of the action, the amount of hydrogenation at a given time being supposed to depend upon the amount of unsaturated glyceride then present; some investigators considered in addition, that evidence of progressive loss of activity in the catalyst was presented by the data obtained. The authors had lately given a different explanation, illustrated by data which showed that the action was largely independent of the amount of unsaturated fat present at a given time and mainly followed what was termed a "linear" course, *i.e.*, the graph correlating hydrogen absorption and time was an almost straight line, or in the case of a mixture of olein and glycerides less saturated than olein, two approximately linear portions connected by an abrupt curve.

The object of the present Paper was to give an explanation of some experiments made in order to account for the discrepant views which at present prevailed on the subject. Since natural fatty oils always contained a mixture of glycerides of varying degrees of unsaturation, each of which was very possibly hydrogenated at a different rate, these materials were not very suitable for studies of this kind. The authors, therefore, examined the hydrogenation of easily purified compounds containing only one ethylenic bond to be saturated, and results obtained with ethyl cinnamate and with enethol were quoted. When these substances were hydrogenated at 140° or 180° C. in presence of nickel in an apparatus into which hydrogen was passed and from which the unabsorbed (excess) hydrogen was allowed to escape, the action was found to take a "linear" course for 60 to 90 per cent. of the total hydrogen absorption, whilst the "constants" calculated for a logarithmic or unimolecular action consistently increased, the final values being 2-2·5 times that of the initial "constant."

On the other hand, if the hydrogen supply were connected to the gas-space above the liquid in the hydrogenation apparatus so that any gaseous impurities accumulated there instead of being continuously removed by passage of excess hydrogen, logarithmic curves were always obtained. Nevertheless, the data did not give constants (calculated from the customary equation $K=\frac{1}{t}\log=\frac{V}{V-v}$) when V was taken as the volume of of hydrogen necessary to saturate the organic compound present; if, however, V was taken as the volume of hydrogen which could be absorbed by the compound before the enclosed gas space in the vessel was completely filled with gaseous impurities present in small amount in the hydrogen extremely concordant values of the constant were obtained.

The result was confirmed by employing hydrogen of varying degrees of purity (97·9-99·2 per cent.)—no impurities toxic to nickel being present—when it appeared that the purer the hydrogen, the lower the value of the "reaction constant" K; in other words, the purer gas was filling up the same volume of gas-space with impurities at a slower rate than that of a gas containing a higher proportion of impurities.

These experiments made it clear that, operating in a closed vessel as described, the action was bound to take a non-linear course by reason of the diminishing concentration of hydrogen present, as small quantities of gaseous impurities accumulated. If these impurities were swept out of the system by free passing of an excess of hydrogen the action was seen to be mainly "linear," and was to be explained by the momentary production of a very unstable complex between nickel and the unsaturated organic compound, this complex then interacting with hydrogen (which might also be definitely associated with the nickel); it was the second (slower) action which was actually measured and proceeded at a constant rate so long as the small omount of nickel-organic compound present remained at the same concentration.

An interesting discussion which followed included a short

Paper read by Mr. Thomas, who criticised the experiment of Drs. Armstrong and Hilditch, from the standpoint of his own researches into catalytic action, full details of which he had incorporated in a previous Paper presented to the Section.

Dr. Armstrong laid particular stress on the importance of catalytic investigation at the present time, as it was a problem which works chemists were coming up against in the ordinary course of their work, and the more that was known about catalytic action the more would it be possible to increase our knowledge of chemical action.

Calcium Sulphate Cements

PROFESSOR P. P. BEDSON presided at a meeting of the Newcastle Section of the Society of Chemical Industry on Wednesday, April 21, when an interesting Paper was read by Mr. C. L. Haddon, giving an account of his recent research work on calcium sulphate cements.

Mr. Haddon explained at length how he had carried out extensive experiments in making briquettes and the strength of the cement was measured by making moulds of 1 sq. in. in cross sections and pulling until they broke with the ordinary cement testing machine. A tensile test gave more concordant results than a crushing test and was easier to manipulate, besides requiring less material. The briquettes were made by sieving the plaster through a sieve containing 2,500 meshes per inch to remove the course particles and then weighed out and mixed intimately with a measured quantity of water until the paste was homogeneous throughout. Some of the paste was then placed in a previously vaselined mould and rammed till all the air holes were pressed out. The ram was allowed to drop about half an inch upon the plaster by its own weight, the operation being repeated until the mould was full, when it was levelled off.

Regarding the method of getting tensile strengths, one way of filling should be selected and strictly adhered to. The briquettes had been weighed six hours after making and then daily, which showed that although more water was originally added than theoretically was necessary it evaporated so quickly that all the cement did not become hydrated. When as large an excess of water as possible was used only about 80 per cent. of the plaster was saturated. In the samples kept over water for a week, to prevent premature drying, the cement was by no means fully saturated. Mr. Haddon produced tables showing that the briquettes took a week to dry but most of the excess water had dried off by the second day. Keeping it too wet did not make for extra strength and had a big effect on the tensile strength.

Formation of the Crystals

On considering the formation of the crystals—small interlocking arms radiating from central crystalline nuclei—it appeared probable that as the water evaporated it deposited its dissolved gypsum on the crystalline arms, strengthening them and adding to the mechanical strength of the whole briquette. The time of setting depended on the temperature of formation, grain size and facilities for drying. The time for reaching maximum strength was about 10 days.

Mr. Haddon quoted many authorities on the subject, and said they all showed that other sulphates in dilute solution reduced the solubility of calcium sulphate, and it was unlikely that their practical work was all wrong and that Rohlands' theory was right. Davis, in the Society of Chemical Industry *Journal* brought forward certain inconclusive evidence to show that when plaster of Paris set orthorhombic crystals were first formed and subsequently those crystals changed into normal monoclinic crystals, which was the customary form for the dihydrate. Obviously, when a change took place there would be a weakening in tensile strength. Setting and change would go on side by side with neat cement and the drop effect due to change would be masked by the increase in tensile strength due to setting, while with much more rapidly setting sulphate solutions, one more or less followed the other and the effect was noticeable. That seemed a simple explanation, but if it were noticeable with sulphate solutions it should be much more noticeable with plaster of Paris and water, and he was unable to find any trace of it there on the second or third day. On the other hand, it might have been due to the excess of water present. It was obvious that after the initial set one was dealing with a fairly concentrated added sulphate solution, and that solution might have had some deleterious effect but a full explanation did not seem possible at that juncture. Nor was it helpful to talk of a sulphate as a catalyzer as that was merely begging the question.

Discussion

Prof. P. P. Bedson said the Paper reminded him of certain research work carried on at Middlesbrough some years ago when they found that the apparently homogeneous rock increased in proportion of silica as they approached the salt bed. This was difficult to understand until it was found that the analyst had not carried out the grinding sufficiently well and had estimated the undissolved calcium suphate as silica. He hoped it would be a warning to analysts to find out what substances actually were before weighing them.

Dr. J. H. Paterson said the Paper was very important and had disproved many of the theories commonly held. He thought Mr. Haddon would be well advised to make that Paper a sort of preliminary foreword on the whole subject, and it would be a pity if he dropped the subject at the present stage. It seemed to him that the more they knew of calcium sulphate cement the more they would know of the more important Portland cement. He admitted that some of his own theories had been upset by Mr. Haddon, who had, he thought, given a much more scientific explanation than his own.

Mr. H. S. Collins said he would like to mention two points. There was a theory that the tensile strength of wood was decreased by the addition of water or oil, the explanation given being that the liquid acted as a lubricant to the plaster. Another point was that he had been surprised to find how very easily gypsum was dried in an ordinary air oven with a comparatively low temperature.

Mr. G. Weyman said that at the gas works the subject had to be studied in a reverse way—their problem had been to prevent it setting. The calcium sulphate did certainly set and set very hard. They had established the fact that if they kept sufficient water vapour present they did not get the hard setting to anything like the same extent. It was an important problem from the gas works' point of view, and they would be glad to have much more information about it.

Dr. A. Fleck said he would like to hear more from Mr. Haddon on the colloidal state.

Mr. Haddon in reply said Mr. Collin's point about the wood tensile strength being reduced was very important, and he thought the lubrication explanation would apply equally well to cements. The tendency of water and oil to creep around solids was well known, and the increase in tensile strength on drying was very possibly due to some such lubricating effect. The question of the dehydration of gypsum was also too important to be overlooked. Gypsum cements should never be used when exposed to great heat, and that appeared to him to explain Mr. Weyman's difficulty, which he had solved by steam heating. Regarding the colloidal theory of the setting of calcium sulphate it was not supported by experimental evidence so far as he was aware. The change, which could be seen under a microscope, showed crystals radiating from different centres and meeting. He thought the calcium sulphate cements were the only cements where a satisfactory theoretical explanation could be obtained as to the mechanical setting.

The report of the Departmental Committee appointed to investigate the danger attendant on the use of LEAD COMPOUNDS IN PAINTING, advises that a regulation should be made prohibiting the use, after three years from the date of the report, of any painting, filling, stopping or similar material which contains more than five per cent. of its dry weight of a soluble lead compound. The Committee recommends that the restriction suggested for paints should apply equally to jointing and bedding pastes. The Committee have also thoroughly examined the conditions under which high-grade pigments are used in coach painting works for heraldic painting, and recommends that this sort of work be exempted from the restrictions, and that conditional exemptions be granted in the case of fine lining.

The Manufacture of Cordite

A Paper by J. W. Parkes, M.Sc., A.I.C.

A MEETING of the Irish Section of the Institute of Chemistry was held on Wednesday, April 21, in the Royal College of Science, Professor W. E. Adeney in the chair, when Mr. J. W. Parkes, M.Sc., A.I.C., delivered an address on the Manufacture of Cordite.

Although guncotton was discovered by Schönbein in 1845, it was not until the researches of Abel in 1866 that the extended use of guncotton was rendered safe by the introduction of the process of pulping and pressing into blocks. In 1846 nitroglycerine was discovered by Sobrero. In 1887 Ballistite, which consisted of guncotton dissolved in nitroglycerine, was invented by Nobel. About this time the British Government appointed a Committee to report on the best explosive of the Ballistite type. Cordite was the result of the deliberations of this committee. This explosive (M.K.1) originally consisted of 37 per cent. guncotton, 58 per cent. nitroglycerine, and 5 per cent. of vaseline (*i.e.*, mineral jelly). At a later period, as a result of the experience of the South African War, the composition of cordite was altered; so that the erosion caused in guns might be lessened. The new cordite (M.D.) has the composition 65 per cent. guncotton, 30 per cent. nitroglycerine, 5 per cent. mineral jelly. Acetone was used for incorporating the constituents of the cordite. At the outbreak of war owing to the scarcity of acetone it was necessary to introduce a new cordite (R.D.B.) with the same ballistic powers as M.D. or M.K.1 cordite, but using a solvent (ether-alcohol) of which greater quantities were available. The new cordite has the composition 42 per cent. guncotton, 52 per cent. nitroglycerine, 6 per cent. mineral jelly. Its use has been adopted by the Army, but the Admiralty have retained the pre-war acetone cordite.

Reference was made to the manufacture of oleum, nitric acid, guncotton and nitroglycerine at Messrs. Kynochs. The various processes were illustrated by a interesting series of slides. The stages in the preparation of cordite were also described in a very clear manner. Special reference was made to the Mannheim Oleum Plant, the Valentiner nitric acid system, the purification of cotton, the pressing of cordite, the winding of the cordite on bobbins, the blending of cordites of different diameters, and the filling of cartridges. Owing to the importance of having uniform quality in the cotton used for nitration the Government during the war took over several factories employed in the preparation of cotton waste: they standardised and perfected the treatment of the cotton, a point of distinct advantage in explosives work. Specimens of cordites of various sizes and cartridges in different stages of manufacture were exhibited.

Discussion

Dr. J. Reilly, in proposing a vote of thanks to the lecturer, referred to the fact that the work of Roger Bacon on the preparation of gunpowder was not empirical but definitely scientific. Although Schönbein and Abel were outstanding names in the history of cellulose nitrate there was another name that deserved mention—V. Lenk, who introduced the Alkali-boil purification process. Reference was made to the work of Robertson on the boiling of cellulose nitrate, and the stabilising results due to the initial acid-boil removing sulpoesters. The physical aspect of the "Thomson Displacement Process" was also briefly considered. Dr. Reilly referred to certain problems of special interest to the research chemist—the comparison of cotton-waste and silver, the treatment of cotton, the formation of oxycellulose, the drying of guncotton and cordite, the comparison of nitro-bodies and nitrate esters, and the problem of stability and stabilisers. Some views on the cordite of the future were put forward, especially from the aspect of eliminating the use of solvents in the manufacture, reference being made to the Nobel patents on this subject.

Mr. O'Farrelly, in seconding the vote of thanks referred especially to two problems which arose in the manufacture of cordite, namely the question of stability and the drying of cordite.

Dr. Leonard, referred to the testing of stability in the manufactured cordite, and to the influence of various stabilisers. He also raised the question of the significance of traces of mercuric chloride in the finished cordite.

Mr. Parkes having replied to the various questions raised in the discussion of the Paper, the meeting terminated.

Fireclay Refractories

Standard Testing Method Required

MR. P. S. DEVEREUX discussed the question of "Fireclay Refractories" at a meeting on Thursday, April 15, of the Birmingham Metallurgical Society. A large company of metallurgists and industrial chemists assembled at the Chamber of Commerce Buildings, and the chair was occupied by Mr. F. C. A. H. Lantsberry, M.Sc., F.I.C.

The author observed that there was a rather widespread idea that, as a general rule, the refractory power of a given material could be increased by mixing with it a second more refractory material. It was commonly supposed that the addition of silica to a fireclay made it more refractory, when, as a matter of fact, the softening point was lowered. The determination of softening point was most satisfactorily carried out in a carbon resistance furnace with the aid of seger cones. Importance must be placed on the mixing of the materials in the manufacture of refractories, because, if not mixed uniformly, the contraction did not take place uniformly, and was set up between different parts of the brick. It was wise to give furnaces a preliminary heating and to coat them with powdered slag, for it gave a resistant glaze. The more silica there was in a fireclay the better it resisted under a load. With regard to the softening of bricks in actual furnace practice, near the combustion chamber, a rather soft brick was best, as it served as a protection against permeation, and threw the strain of the load on to the cooler parts of the brick. Graphite crucibles usually had to bear a great weight, and the binding clay was most important; Klingenberg clay was the best, but Dorset ball clay was nearly as good. The low heat conductivity of chromite bricks was their chief attribute, this not diminishing even at high temperature. An ore running from 40 to 50 per cent. chromic oxide and from 3 to 7 per cent. silica made the best refractory. Bauxite and alumina bricks had not had a fair chance. While resistant to slags, they must be prevented from high shrinkage by high firing first.

Magnesite Bricks

The great trouble with magnesite bricks was their tendency to crack, flake and spall at high temperatures. Magnesia from calcined magnesite occurred in two different forms, one of which had a lower specific gravity of 3·2, and was more chemically active than the other form with specific gravity of 3·7. There was thus a shrinkage caused by this change from low to high specific gravity. This should be effected in the manufacture of the bricks, but the conversion was never complete, even if the firing were continued well over 1,650°C.

As to the higher refractories, although electric furnace development had been phenomenal, it was greatly retarded by want of suitable refractories. Pure magnesia did not liquefy until a temperature of 2,800°C. was attained. If any quantities of alumina, no matter how small, were mixed with the magnesia, the liquefaction temperature dropped from 2,800°C. to 2,030°C. By mixing together magnesia and alumina, the compound magnesium aluminate would form even at temperatures considerably below its melting point. The formation of this compound usually resulted in a mass of small interlacing crystals, and consequently gave a product of increased mechanical strength and toughness. In a high-temperature furnace or kiln, where the internal temperature required was higher than the refractory lining would withstand, it was customary to protect this lining by artificial cooling, either by means of air or water. The ideal arrangement would be to cover the outside of the furnace with a good thermal insulator, so as to retain this heat in the furnace; but in many cases, under present conditions, such an insulation would result in the rapid destruction of the refractory lining, owing to the fact that the lining would soon attain the temperature of the inside of the furnace. It was obvious that the development of refractory materials which would permit the thermal insulation of industrial furnaces would result in an enormous fuel saving. The present methods of testing refractory materials needed to be standardised, and to this end a provisional specification had been prepared by a committee of the Refractories Section of the Ceramic Society.

A. BEEBY THOMPSON & PARTNERS, the well-known petroleum engineers, have been appointed consulting engineers to the Trinidad Dominion Oil Co.

Chemical Trade Organisation

In reply to requests "to state concisely the nature of its operations and activities since its formation early in 1918," the British Chemical Trade Association has issued a pamphlet which gives this information, and, further, offers a general justification of the Association's existence and work. Its objects, as defined here, are such as would secure general acceptance anywhere; but what the Association most relies on is its record of work, and this, it must be said at once, looks useful and practical. We cannot imagine that the compilers of the pamphlet have been unconscious of the movement to establish another association, but wisely they have refrained from anything of a critical or provocative nature, and we believe they are sincerely anxious that some means should be found of averting needless rivalries, and of securing united action in the interest of the chemical industry.

Among the practical work reviewed, mention is made of the formation of sub-coommittees to deal with specific groups of products (such as dyestuffs, for example), and of the arrangements now being made for a branch to deal with the pharmaceutical trade. The Association has introduced a standard form of contract and rules of arbitration; these rules, it is stated, have been extensively used, and have proved a satisfactory means of saving time and expense. The Association, again, has opposed, and will continue to oppose, the imposition of controls or restrictions, which are considered detrimental to the development of the trade of the country. In connection with the recent restrictions on the importation of chemicals, the Association claims to have been of much practical help to the chemical merchant. An advisory committee was formed which assisted the Board of Trade in the issue of licenses. The Association was given direct representation on this committee, and its representative, it is stated, was the sole member to protect the merchants' interests.

"Chemical traders," the pamphlet proceeds, "whether members of this Association or not, benefited in no small way from the good work done on this committee by the Association. Many traders made a practice of regularly sending copies of all their applications for licences to the Association, and our official regularly attended at the Board of Trade offices several times weekly in support of such applications. . . . For the time being the restrictions on importation of chemicals, dyestuffs, &c., have ceased, but it is understood that in the near future legislation giving the Government power to re-impose these restrictions may be introduced. It is at the moment uncertain how far-reaching the proposed restrictions will be, but, whatever they are, it is feared that they will most certainly be detrimental to the business of the chemical merchant. This Association will, when the time arrives, submit to the Government, on behalf of the trade, their considered opinion on such questions. With the reintroduction of the restrictions on trade it is probable that another "Advisory Committee" will be set up, on which the Association will doubtless be given representation in the interests of chemical merchants. We would specially point out the democratic lines on which the Association is based. The Association is in no sense a "ring," nor is it run for the benefit of any individual or group. The Association exists for the good of its members in particular, and for the benefit of the trade in general.'

Dr. J. H. Andrew has been appointed to the Chair of Metallurgy in the Royal Technical College, Glasgow, vacant by the transfer of Dr. Desch to the University of Sheffield. Dr. Andrew graduated in Manchester University with first class honours in chemistry. After research work in metallurgy, he received the M.Sc. degree in 1908, and was awarded the Dalton scholarship. He continued metallurgical investigations in the university laboratories until 1914, was appointed research fellow and demonstrator in 1910, and Carnegie scholar of the Iron and Steel Institute. He received the degree of D.Sc. in 1915. Since June, 1914, Dr. Andrew has been chief of the Metallurgical Research Department of Sir W. G. Armstrong, Whitworth & Co., Ltd., Manchester, and has gained a wide experience in the metallurgical industry, having had unlimited scope for studying practice and for research. His publications include a number of important Papers presented to the leading metallurgical societies.

Benn Brothers' Annual Staff Dinner

The staff of Benn Brothers, Ltd., were entertained by the directors to dinner at the Holborn Restaurant, London, on Friday, April 23. Sir John Benn (the chairman of directors and founder of the firm) was in the chair, accompanied by Lady Benn, and all the employees, including the provincial representatives, were present, the company numbering about 190 in all.

Mr. Ernest Benn, C.B.E., in submitting the toast of "The Staff," reminded the company that this was the first anniversary of the establishment of Benn Brothers' Prosperity Sharing Scheme. Since they last met at their staff dinner they had had to mourn the death of Mr. Julius Benn, one of their founders, and the absence of Mr. Haslam, through continued illness which had caused his retirement from the Board. It had been their pleasure and duty to add to the staff during the year some 10 or 12 ex-officers of H.M. Forces, and he offered a hearty welcome to those newcomers, whose presence among them would be a source of strength to their organisation in helping to maintain the great name and traditions of Benn Brothers. The year through which they had passed had been one of the most remarkable for its hopes and its realisations in the history of the publishing profession. On the one hand it was full of marvellous successes; on the other, it had brought difficulties in regard to printing and paper supplies that rendered the outlook most serious indeed. Just as they worked and strove to build up their pages so they found costs advancing against them.

Mr. Benn proceeded to refer to the satisfactory working of the Saturday closing arrangements, and to the bonus sharing scheme. Last year they had paid to each member a sum equal to a dividend of 5 per cent. upon the annual value of their wages. A similar bonus was distributed among the staff at the end of the first six months of the current year. Owing to the difficulties arising out of the unprecedented situation in the paper trade the prospect had become problematical, and it was impossible at the moment to make any definite statement as to whether the result of the year's working would enable them to make a second distribution in June. The success of Benn Brothers as a firm he attributed, among other causes, to the fine spirit of loyalty and co-operation which ran through the whole of the establishment, and to the development of the system of individual responsibility, all having some degree of responsibility placed upon them, and being made to feel that success depended entirely upon their efforts. It was a plan that made for efficiency.

Mr. E. E. Starke, in responding, after paying a tribute on behalf of the staff to the memory of Mr. Julius Benn, said that the directorate of Benn Brothers, which had preserved its character through so many years and whose traditions were so intimately associated with our commercial life, was the personification of the qualities that had made the firm so great and powerful a name in the publishing profession. The excellent results of which Mr. Ernest Benn had spoken would never have been achieved had they not been influenced by men of brain, foresight and appreciation. The closing of the office on Saturdays, and the bonus scheme were considerations in the interest of the staff, which had served further to cement the very friendly relationships that had always existed between employer and employee at Bouverie-street. Everyone who served, in whatever capacity, on the staff of Benn Brothers realised the difficult times through which they were passing, and he could assure the directors that they would receive the hearty support and loyal co-operation of all the staff in the future as in the past.

Sir John Benn, in briefly acknowledging the toast of "The Firm" (proposed by Mr. W. E. Warrilow), remarked that the forty years since he founded The Cabinet Maker, the first of the series of papers now owned by Benn Brothers, Ltd., had brought him many friendships and left fragrant memories of faithful service.

The name of Capt. Wedgwood Benn, M.P., was also coupled with the toast, and he replied in felicitous terms, remarking that whenever he addressed such gatherings he was always conscious of the fact that while Benn Brothers was a very efficient machine it was also a very human machine.

Chemical Matters in Parliament

Glass Research Appointment

IN reply to questions by Mr. Acland in the House of Commons on April 26, with regard to the recent Glass Research Appointment, Mr. Fisher stated: The director appointed by the Glass Research Association has no academic degree, but his intimate connection with the industry, both in the practice and research work of glass factories, and as an external consultant for over 20 years, are regarded by the Advisory Council for Scientific and Industrial Research as the qualifications proper for this post. When the Advisory Council approved the expenditure involved in his appointment they took into consideration the facts that no other candidate was available with the wide and prolonged practical knowledge of the glass trade necessary in the present condition of the industry in this country, and that the successful candidate had not only carried out much research work, particularly on the mechanical engineering side of the industry, but had also a thorough knowledge of the manufacture of glass of nearly every type. The list of researches carried out by him is very long, and includes work on furnace design in its relation to the use of various fuels, on the development of heat and electrically resisting glasses for various purposes, on the utilisation of waste products from other industries, on furnace and pot linings used in making special glasses, on methods of treating, forming and firing refractory materials, on the electrical melting and annealing of glasses, on the development of tube-drawing devices and devices for delivering charges of glass to forming apparatus. He has also published a number of articles on problems encountered in glass manufacture, many of them in the *Journal* of the American Ceramic Society; on the other hand, many of his investigations have been carried out for various firms, and the results of these are, therefore, not available for publication. I shall be happy to show the right hon. member a complete list of the researches undertaken by the director and of his published Papers.

Oil Boring in Derbyshire

In reply to Sir Arthur Fell (House of Commons, April 26), who asked for further information regarding oil boring in Derbyshire, Mr. Bridgeman said the position remained the same as given in a reply on March 8. The well at Hardstoft continued to flow at the same rate, and the crude oil was, for the present, being held in storage.

Bacon for Soap

Sir W. Mitchell-Thomson, Parliamentary Secretary to the Ministry of Food, informed Major Barker (House of Commons, April 27) that the Ministry of Food had no records which would give the weight of bacon destroyed or sold to soap-makers during the 12 months ended April 20, as in the early part of the period importation was in trade hands. Any bacon which was condemned or sold to soap-boilers subsequent to the resumption of control was imported on private account. In normal times, under the most favourable transport conditions from the packing house abroad to the consumer in this country, a certain percentage of bacon always became unfit for food, and was consequently either destroyed or sold to soap-boilers. In the absence of comparative figures, it was not possible to say how last year compared with normal years in this respect.

Royal Dutch Shell Group

Sir W. Joynson-Hicks asked the Chancellor of the Exchequer (House of Commons, April 26) whether the Government had had frequent opportunities of acquiring a controlling interest in the Royal Dutch Shell Company; and, if so, why they refused to enter into an arrangement which, as in the case of the Anglo-Persian Oil Company, would ultimately prove of great advantage to the national interests?

Mr. Chamberlain: I am not aware that this Government or its predecessors have had any opportunity of acquiring a controlling interest in the Royal Dutch Shell Group in any way comparable with the interest obtained in the Anglo-Persian Oil Company.

Ferrous Metal Sales Stopped

In reply to Brigadier-General Croft (House of Commons, April 28) who asked whether the Controller of Ferrous Metals had been ordered to discontinue all sales for a month, owing to the confusion that had been made by the same material being sold to more than one purchaser, Mr. J. F. Hope, Parliamentary Secretary to the Ministry of Munitions, stated that the sales had been discontinued in order to facilitate the clearing of depots and the delivery of over 300,000 tons of material which had already been sold. It was also necessary to review the balance of the material, which amounted now to approximately 30,000 tons.

Gretna and Waltham Abbey Factories

In reply to Brigadier-General Colvin (House of Commons, April 28), Mr. Hope stated that in estimating the cost of manufacture of cordite at Gretna, the maintenance charges had been taken into account. The relative costs of production at Gretna and Waltham Abbey were not strictly comparable, as the processes were different.

Chemical Trade Inquiries

Locality of Firm or Agent.	Materials.	Ref. No.
Canada (Toronto)	De-natured alcohol	...
Eygpt (Cairo) ...	Oils and paints, &c.	561
Denmark (Copenhagen)	Oil, and spirit varnishes	569
Cuba Havana) ...	Soap; paraffin	587
Australia (Brisbane)	Drugs and scientific preparations ...	595
Canada	Fertilisers, basic slag. Replies to the Office of the High Commissioner for Canada, 19, Victoria Street, London, S.W.1.	...
Winnipeg ...	Chemicals, &c.	603
Italy (Milan) ...	Heavy chemicals, metals, raw materials, &c.	611

H.M. Trade Commissioner at Toronto informs the Department of Overseas Trade that among numerous local applicants for United Kingdom agencies are many who are quite unsuitable for the representation of British trade in his area. It would appear to be in the best interests of United Kingdom firms to consult the Trade Commissioners before making appointments of local agents. It is not sufficient for a prospective agent to state in his correspondence with firms that their name has been obtained by him from the Commissioner's office, because in some cases he may have obtained names and addresses from trade journals and failed to register his requirements and references.

The British Chemical Trade Association

THE Department of Overseas Trade has advised the Association that a Buenos Aires firm desire to take up agencies for heavy and fine chemicals.

The Department has also advised the Association that a Madrid firm desire quotations from British exporters of the following:—

Sal ammoniac.	Bichromate of soda.
Alum chrom.	Alumina sulphate, 17/18 p.c.
Sodium hyposulphate.	Sodium sulphide, 60/62 p.c.
Bleaching powder 35/37 p.c.	Kaolin.

The firm propose to import the above in considerable quantities. Quotations should be c.i.f. Barcelona or Northern Spanish port.

The Patent Parquet Co., Runhall, Attleboro, P.O. Norfolk, are requiring supplies of methyl alcohol, up to 300 gallons. Members interested should communicate direct with the firm.

Acetanilid U.S.P. Powder, c.i.f. Rotterdam

Will members kindly forward any information from their records of sales or quotations as to the fair market price of the above article during the month of March and the first two weeks in April, 1920? Any information furnished will be treated as confidential, and the member's name will not be disclosed without his consent being previously obtained.

From Week to Week

In the House of Lords on Monday, PRICE'S PATENT CANDLE CO. BILL was read the third time, and passed, with amendments.

The death took place at Basle last week, after a long illness, of Mr. F. HOFFMANN, chairman of the Hoffmann-La-Roche Chemical Works, Ltd.

J. BROWN & CO., LTD., manufacturing chemists, Savile Town, Dewsbury, announce that they have taken over, as a going concern, the business of Fletcher Brothers & Co., Wellowgate, Grimsby.

INVESTIGATIONS BY DR. HARKER, of Sydney University, on the utilisation of Zamia palm for the production of industrial alcohol or starch, show that yields obtainable are very similar to those obtained from potatoes.

A private conference was held on Tuesday between the ELECTRIC LAMP MANUFACTURERS' ASSOCIATION and manufacturers of the glass bulbs, in order to discuss a proposal for the further standardisation of British-made glass bulbs.

A model village on the lines of Port Sunlight is in course of formation at LEVER BROTHERS' ASSOCIATED MARGARINE WORKS at Bromborough, Cheshire. As a preliminary step, 1,000 houses are to be built, many of which are already under construction.

At the CENTRAL CRIMINAL COURT last week, C. W. Nairne (43), engineer, was sentenced to 14 months' imprisonment with hard labour on a charge of obtaining £101 and £55 from the Anglo-American Oil Co. by false pretences, and also ordered to pay £200 to the prosecutors towards the costs of the prosecution.

In view of statements which have appeared in the Press, the SHELL TRANSPORT & TRADING COMPANY announce that no negotiations are in progress for securing Government control of the "Shell Group," or for the sale or transfer of any shares in the "Shell" Company to the Government.

Among the donations received in answer to LIVERPOOL UNIVERSITY'S APPEAL for funds are £15,000 from Alfred Holt & Co. to establish a Chair of Metallurgy in memory of their late partner, Mr. Henry Bell Wortley; £10,000 from the United Alkali Co., and £5,000 from Pilkington & Sons towards the building of new chemical laboratories.

Mr. Alfred Armitage, chairman of the BRITISH MOTOR SPIRIT COMPANY, who is at present visiting the properties of the company in America, has cabled that he is thoroughly satisfied with the technical and financial position of the company there. Two new wells have been brought in, and the output is increasing to 1,100 barrels per day. Crude prices have risen to $3.50 and $3.75 per barrel.

The withdrawal of the DARTMOOR AND DISTRICT HYDRO-ELECTRIC SUPPLY BILL, which has been before a House of Lords Committee, is not expected to affect the copper refining proposals of the Wilson syndicate. The winning of the lignite (huge tracts of which have been purchased), the refining of copper, and the utilisation of the by-products from the lignite will proceed as arranged.

Major G. W. C. Kaye, in his concluding lecture on the "DEVELOPMENT OF X-RAYS," at the Royal Institution last week, said it had been found possible to penetrate three inches of steel, six inches of alloy, and as much as 12 inches of wood by X-Rays. Lead was a much more effective resistant, and it had been found that complete protection for the operator would be provided by about one-eighth of an inch of lead.

It is announced that applications for not more than three RAMSAY MEMORIAL FELLOWSHIPS for chemical research will be considered by the trustees at the end of June next. They must be received by June 15 at the latest by Dr. W. W. Seton, organising secretary, Ramsay Memorial Fund, University College, Gower Street, W.C.1. The fellowships will each be of the annual value of £250, with, possibly, a grant of not more than £50 per annum for expenses, and tenable for two years, with the possible extension of a year.

Mr. G. PROVOST, of Bath, who, after 2½ years of experiment, has discovered a method of producing various colours in glass by the action of the Bath mineral waters, has formed conclusions, as the result of his researches, which lead him to question the opinion of Sir William Ramsay that the staining of the drinking glasses by the deposit contained in the waters is the result of direct chemical action, amounting to actual permeation of the glass. Mr. Provost has been able to remove this deposit by the application of hydrochloric acid, proving that the actual composition of the glass is unaltered.

THE INDUSTRIAL COURT issued on Monday its decision in an application by various unions to the Drug and Fine Chemical Manufacturers' Association for an advance in wages for workers engaged in the chemical industry on the grounds of the increased cost of living and the nature of the work done. The last advance, made in January, was one of 5s. per week to all adult male workers and 2s. 6d. a week to all adult female workers. The Court held that, as the official returns showed no material alteration in the cost of living since the last advance was given, the claims for increased wages at the present time had not been made out.

THE ANNUAL MEETING of the London Section of the Society of Chemical Industry, fixed for Monday evening next in the Rooms of the Chemical Society, promises to be of more than usual interest. Apart from the annual business, which may include some reference to the coming retirement of Dr. Stephen Miall, the hon. secretary and treasurer, three important Papers will be communicated: "The Theory of Gas-scrubbing Towers with Internal Packing," by Professor Donnan and J. I. Orme Masson; "The Preparation of Picryl Chloride," by P. F. Frankland, F.R.S., and A. F. Garner; and "The Preparation of Thiocarbonyl Tetrachloride," by P. F. Frankland, F. Challenger and Miss D. Webster, B.Sc.

In connection with the shipment from this country to Vera Cruz of a large quantity of CYANIDE OF SODA it is interesting to learn that the American cable censor is responsible for the new 1920 contracts not going to the United States, as, during the war, cables asking for quotations were held up for 30 days. Owing to the delay the contracts were given to British firms. It is estimated that the Mexican mines use from 5 to 6 tons of cyanide a month. A large supply was received from Glasgow last month and it is stated to be of better quality than that shipped by the Americans to Mexico. Consequently it is believed that there is a good chance of holding the business which has previously gone to the United States.

The Vice-Chancellor of Cambridge University calls attention to the fact that, at a recent meeting of the Fellows of the Royal Society and members of Cambridge University, it was resolved that steps be taken to raise funds for a MEMORIAL TO LORD RAYLEIGH in Westminster Abbey, and to promote research in some branch of science with which Lord Rayleigh was associated. It is estimated that the cost of the window in the Abbey will be several thousand pounds. Donations may be sent to the treasurers, Sir Richard Glazebrook and Sir Arthur Schuster, at 63, Grange Road, Cambridge, or they may be paid to the account of the Lord Rayleigh Memorial Fund with Barclay & Co., Ltd., Benet Street, Cambridge.

The death is announced, at the age of 62 years, of PROFESSOR LUCIUS TRANT O'SHEA, for many years professor of applied chemistry at the Sheffield University, Fulwood-road, Sheffield. For 25 years Professor O'Shea made a special study of the chemistry of fuel, particularly in connection with coke-oven development and the preparation of fuel for industrial purposes. He also devoted much attention to the subject of sulphur in coal mines. His published works include "Elementary Chemistry for Coal Mining Students," "A Contribution to the History of the Constitution of Bleaching Powder" "Retention of Lead by Filter Paper" "Notes on the Woolwich Testing Station," and "The Safety of High Explosives: With Special Reference to the Methods of Testing."

THE MINISTRY OF HEALTH has appointed a Committee to consider and advise upon the legislative and administrative measures to be taken for the effective control of the quality and authenticity of such therapeutic substances offered for sale to the public as cannot be tested adequately by direct chemical means. The Committee consists of the following members: Sir Mackenzie D. Chalmers, Mr. H. H. Dale, head of Department of Biochemistry and Pharmacology under Medical Research Councils; Mr. C. F. M'Cleary, Medical Officer, Ministry of Health; Mr. A. B. Maclachlan, Assistant Secretary, Ministry of Health; and Mr. C. J. Martin, Director, Lister Institute of Preventive Medicine. The secretary of the Committee is Mr. E. W. Adams, of the Ministry of Health, Whitehall, S.W.1.

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The annealing temperatures of magnesia soda glasses. S. English and W. E. S. Turner. *J. Soc. Glass Tech.*, December, 278-281.

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The estimation of iron in iron ores by means of permanganate. R. Schwarz. *Chem.-Zeit.*, April 22, 310-311.

COAL. Coal ash. O. Stutzer. *Metall. u. Erz.*, March 22, 150-152. Notes on the composition of ashes from various coals.

Patent Literature

We publish each week a list of selected complete specifications accepted as and when they are actually printed and on sale. In addition, we give abstracts within a week of the specifications being obtainable. Readers can thus decide what specifications are of sufficient interest to warrant purchase, the only way of obtaining complete information. A list of International Convention specifications open to inspection before acceptance is added, and abstracts are given as soon as possible.

Abstracts of Complete Specifications

122,172. ALKALINE MONOCHROMATES, PROCESS FOR TRANSFORMING INTO BICHROMATES. Société Industrielle de Produits Chimiques, 10, Rue de Vienne, Paris. International Convention date (France), January 5, 1918.

A solution of sodium monochromate is mixed with ammonia and the mixture is saturated with carbon dioxide, so that an excess of ammonium bicarbonate is present and the temperature is maintained between 30° and 35°C. Sodium bicarbonate is precipitated and filtered off and dried. The solution contains ammonium chromate and a small proportion of sodium chromate, and is distilled to remove the ammonium carbonate or bicarbonate; slaked lime is then added in quantity equivalent to the quantity of the ammonia still present in the form of ammonium mono or bichromate. The mixture is then distilled to remove the ammonia, and the residue consists mainly of calcium chromate mixed with a small proportion of the original sodium chromate. The residue is then mixed with the equivalent quantity of sodium bisulphate, when double decomposition takes place and calcium sulphate is precipitated. The solution containing sodium bichromate is filtered off, evaporated and crystallised. This process enables sodium bichromate to be obtained from sodium chromate by the use of sodium bisulphate which is relatively cheaper than the carbonate, while the sodium originally contained in the chromate is recovered as bicarbonate.

131,283. HYOSCYAMINE, PROCESS FOR THE ISOLATION OF. Chemische Fabrik vorm. Sandoz, Basle, Switzerland. International Convention date (Switzerland), August 15, 1918.

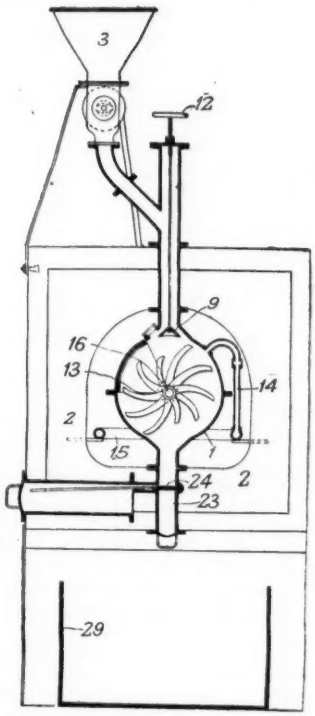
The raw solanaceous material is treated with dilute mineral or organic acid or salts, such as aluminium or ferrous sulphate, ferric chloride or copper sulphate, to fix the alkaloid in the insoluble vegetable substance in the presence of the fat solvents non-miscible with water and having a low boiling point, such as benzene. An addition of 1 to 7 per cent. of alcohol is preferably made to the fat solvent to extract colouring matters, phytosterols, vegetable acids, and their esters. A preliminary purification of the vegetable substance is thus effected, and it is then treated with a further quantity of fat solvent and ammonia to liberate the hyoscyamine, the solution of which is then drawn off.

140,478. GLYOXAL, PROCESS FOR THE PREPARATION OF. E. C. R. Marks, London. (From A. Bosshard, Ottiker Strasse 38, Zurich 6, Switzerland). Application date, October 11, 1917.

It is found that ozonised oxygen or air will react with acetylene gas to produce glyoxal, when the ozone is present only in the proportion of 1 to 2 per cent. If aqueous vapour or a spray of water be introduced into the mixture the glyoxal is washed out as it is formed and may be separated as a concentrated solution.

140,484. CYANOGEN COMPOUNDS, AMMONIA AND THE LIKE, PRODUCTION OF. G. Calvert, Elmhurst, Arlington Road, Twickenham Park, Middlesex. Application dates, October 21 and November 21, 1918.

The process is for producing cyanide by heating together sodium or potassium carbonate, carbon, and a catalyst such as iron powder, in the presence of nitrogen or a gas containing nitrogen. The reaction mixture is fed from a hopper 3 into the reaction vessel 1, which is constructed of a nickel chromium alloy such as "cronite." The reaction vessel is arranged in a furnace 2 heated by producer gas, and nitrogen is admitted through the pipe 14 from a gas ring or coil 15 arranged in the furnace to preheat the gas. Admission of the charge to the vessel 1 is controlled by a valve 9 operated by a handwheel 12. The charge is heated to about 950°C., and is thoroughly mixed by the rotating blades 13 which are spaced longitudinally on the shaft 16 so as to cover every part of the vessel 1. The heated mass is finally discharged through a pipe 23 controlled by a valve 24, and passes to a tank 29, where it is lixiviated. A modification is also described in which the operation is continuous. The reaction vessel is horizontal and a horizontal shaft passes through it carrying blades of right and left-handed pitch. One set of blades moves the charge towards the outlet and the other set tends to move it backward at a slightly slower rate, so that mixing



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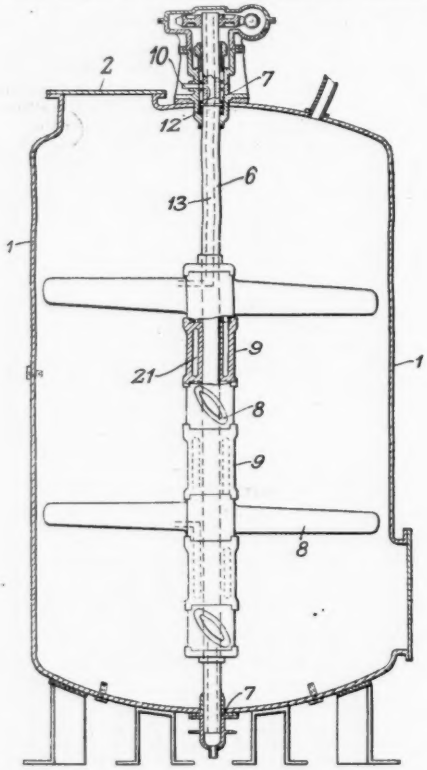
is effected. A diluting material such as carbon may be added to prevent sintering or welding of the catalyst, and the alkali may be in such excess that the catalyst and carbon are suspended in it, the supply of carbon and alkali being maintained as required. The alkali carbonate may be replaced by metallic sodium which may be introduced in molten or gaseous form while the carbon may be introduced in the form of carbon monoxide. The cyanide may be treated with steam at about 500°C. to produce ammonia.

140,505. AMMONIA, PROCESS OF RECOVERY OF. W. J. Chrystal, 7, West George Street, Glasgow. Application dates, December 3, 1918, and May 31, 1919.

The object is to produce a neutral solution of ammonium sulphate without loss of ammonia gas. The absorbing vessel is divided into two parts by a vertical partition and the sulphate liquor in the first compartment is allowed to become neutral by absorption of ammonia, the gas passing from the first compartment into the second. A quantity of the liquor in the first compartment is then run off and replaced by liquor from the second compartment. The degree of acidity in the second compartment is periodically tested and is maintained at 2 to 3 per cent. By this process a supply of completely neutral liquor is obtained.

140,513. OIL EXTRACTION APPARATUS. H. Engel, Oak Lodge, Royston Park, Hatch End, Middlesex. Application date, December 20, 1918.

The process is for extracting oil from pea, bean, or like meal or other finely divided oil-containing substances by means of solvents. The material and the solvent are introduced into the vessel 1 through the opening 2 and subjected to heat and stirring. The shaft 6 carries a number of hollow stirring



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blades 2 spaced apart by distance pieces 9. Steam is admitted through an inlet 10 in the upper bearing 7 and passes through a lateral opening 12 into the central passage 13 in the shaft. The steam then passes through a U-shaped passage in each blade of the first stirring element, then back to the distance piece 9 and through the annular passage 21 to the next stirring element 8. The pitch of the blades is such that the material and solvent are moved upward by it and thereby agitated and heated.

140,563. ELECTROLYTIC CELL. J. Harris, 1229, Manor Park Avenue, Lakewood, Ohio, U.S.A. Application date, February 21, 1919.

The electrolytic cell is more particularly for the generation of oxygen and hydrogen by the electrolysis of water. The

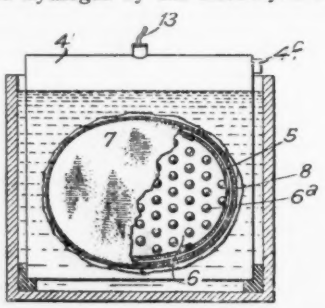

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illustration shows one of the units in side elevation; it comprises a narrow open bottom casing 4 having in each side wall an opening surrounded by a flange 5 projecting outwards. A cast-iron electrode 6 is mounted in each opening and is slightly smaller than the opening; the outer face of the electrode is provided with projections 6a. An asbestos diaphragm 7 is applied to the opposing flanges 5 of adjacent units by a clamping ring 8. The clamping rings are of such a width that they span the spaces between two adjacent units and thus enclose a chamber between two opposed diaphragms. The ring is perforated at its upper side so that the chamber communicates with the liquid in the tank. An insulated conductor 13 passes through the casing 4 and is connected to a pair of electrodes 6, and the wires 13 are alternately connected to positive and negative terminals. Oxygen and hydrogen are liberated at the opposed electrodes and pass into alternate cells 4, and thence by outlets 4c.

140,635. VACUUM PANS AND OTHER LIQUID HEATING APPARATUS, TUBULAR HEATING APPLIANCES OF. Fawcett Preston & Co., Ltd., 17, York Street, Liverpool. (From H. W. Taylor, Sunnyside, Phœnix, Mauritius). Application date, May 3, 1919.

A vacuum pan having a conical bottom is provided with circular steam-heating tubes arranged in two layers parallel to the conical bottom. The tubes are divided into two semicircular parts by diametral headers, and some of them are divided into four sections by other intermediate headers. The headers are provided with partitions which compel the steam or heating fluid to pass backward and forward from one header to the other.

140,694. PYROGALLIC ACID, PROCESS FOR THE PREPARATION OF. E. C. R. Marks, London. (From Nitritfabrik Aktiengesellschaft, Coepenick, near Berlin). Application date, August 29, 1919.

Solutions or suspensions of tannin or gallic acid are heated with barium hydrate in an autoclave to above 160°C. for some hours; pyrogallic acid is produced in nearly theoretical yield and may be crystallised. The metallic compound added should be such that only the hydrogen atoms of the carboxyl groups originally present and those formed by the hydrolysis of the tannin are substituted by metal.

140,715. FILTER PRESSES. P. W. Norman, 72, Waldegrave Road, Teddington, Middlesex, and the Aluminium Plant & Vessel Co., Ltd., Point Pleasant, Wandsworth, London, S.W.18. Application date, October 27, 1919.

In filter plates, the usual discharge duct for the liquid is not made parallel to the face of the plate by coring it during casting, but the duct is drilled from the face of the plate in an inclined direction to meet the common discharge conduit. The walls of the duct are thus made smooth and it is easily accessible for cleaning.

NOTE.—Specification No. 130,966 which is now accepted, was abstracted when it became open to inspection under the International Convention; it relates to sulphuric acid containing nitrogen oxides. (*See* THE CHEMICAL AGE, Vol. I., page 504.

International Specifications Not yet Accepted

138,858-9. ELECTRIC FURNACES. Soc. Anon. des Ateliers de Sécheron, Sécheron, Geneva. (Assignees of A. von Zeerleder, Berne, Switzerland). International Convention date, February 12, 1919. Additions to 133,706.

138,858. In the electric resistance furnace for heating a crucible, described in 133,706, the terminal rods embedded in the resistance material project through a plug of heat-insulating material to the outside of the casing. The heat-insulating material may be chamotte, quartz sand, or asbestos.

138,859. In the type of electric resistance furnace, described in the preceding abstract, additional thin rods of resistance material may be embedded in the resistance mass to facilitate initial heating.

138,862. ELECTROLYSIS. Fredriksstad Elektrokemiske Fabriker Aktieselskabet F.E.F., Fredriksstad, Norway. International Convention date, February 13, 1919.

An electrolytic cell for obtaining caustic soda and chlorine by the electrolysis of brine is provided with a cathode of wire cloth

covered with asbestos and inclined at an angle of about 45°. A diaphragm may be formed by feeding loose granular material such as salt on to the upper end of the cathode so that it is distributed over the asbestos by gravity. The salt is continuously supplied as it is dissolved. A deflecting plate is provided to prevent escape of the chlorine through the salt inlet, and the anode is constituted by a number of rods parallel to the cathode. A number of such cells may be bolted together so that the inclined bottom of one forms the roof of the cathode chamber of the next.

138,869. DISTILLING. E. Barbet et Fils et Cie, 5, Rue de l'Echelle, Paris. International Convention date, February 8, 1919.

In rectifying alcohol, &c., the vapour from a rectifying column is led to a single tubular condenser and the condensate is divided into two parts, one of which passes back into the rectifier and the other constitutes the distillate. The reflux portion passes through coils immersed in the liquid on the trays of the rectifier so that it is heated before passing into the top of the rectifier. The apparatus may also be used for rectifying toluol, xylol, petroleum, &c.

138,924. ZINC OXIDE. New Jersey Zinc Co., 160, Front Street, New York. (Assignees of F. G. Breyer and E. H. Bunce, Palmerton, Pa., U.S.A.). International Convention date, August 9, 1918.

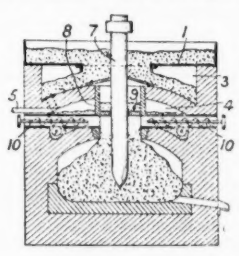
Zinc oxide is allowed to fall in a thin stream through a long vertical retort which is kept at a temperature between a red and yellow heat, and the oxide is then kept in a receptacle at the same temperature for some time. The appearance of the zinc oxide is thereby improved.

139,147. PHENOL-ALDEHYDE CONDENSATION PRODUCTS. L. Jaloustre, Z. Kheifetz, and M. Warchavsky, 18, Place de Laborde, Paris. International Convention date, February 19, 1919.

Phenols and aldehydes are first heated with catalysts, such as sodium salicylate or ammonium sulpho-cyanide to produce soluble condensation products, and these products are then rendered insoluble by heating with other catalysts such as sodium cyanide or ammonium chloride. The products may be used for making various coating compositions or moulded articles, and may be mixed with cellulose and other esters, albumens, camphor, &c.

139,160. ELECTRIC FURNACES FOR THE EXTRACTION OF ZINC. B. Raeder and Aktieselskabet Zink, Kykkelsrud, Askim, Norway. International Convention date, February 15, 1919.

The charge is pre-heated in a chamber 4 by means of combustible gas supplied by the pipe 5 and is then conveyed by cooled conveyors 10 into the chamber below, where it is electrically heated. The heating gas may be carbon monoxide from the zinc condensers. A drying chamber may be arranged above the pre-heating chamber and may comprise an open upper compartment 1 and a lower compartment 3 heated by



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hot gases from the pre-heating chamber 4. The electrodes 7 may be protected in the chamber 4 by wide sleeves 8 containing some of the powdered charge 9 to act as a seal.

139,159 and 139,168. PURIFYING WASTE LIQUIDS. Koppers Co., Union Arcade Building, Fifth Avenue, Pittsburgh, U.S.A. (Assignees of H. S. Davis and S. D. Semenow; and C. A. Basore, respectively, Pittsburgh, U.S.A.). International Convention date, February 15, 1919.

139,159. Waste liquor from ammonia stills, containing phenoloid bodies, is filtered through ground lignite, peat, &c., to absorb phenols.

139,168. The filtering material is animal charcoal, which is afterwards revivified.

139,172-3. SULPHUR DIOXIDE FROM SLAG. L. H. Diehl, 4A, Prager Platz, Wilmersdorf, Berlin. International Convention dates, January 16 and September 24, 1917.

139,172. The sulphides in liquid blast furnace slag are oxidised to produce sulphur dioxide by passing air through the slag, or by adding an oxidising agent, such as calcium or magnesium sulphate. The process is described in detail.

139,173. (Addition to 139,172). A detailed description of the apparatus for carrying out the preceding process is given.

139,194-5. ALUMINIUM AND ALUMINIUM NITRIDE. V. Gerber, 55, Sihlquai, Zurich, Switzerland. International Convention date, February 18, 1919.

139,194. Aluminium is obtained by blowing hydrogen or hydrocarbon gas, with or without finely divided carbon, through molten alumina in an electric furnace. The aluminium vapour is condensed.

139,195. When the above process is modified by the addition of nitrogen to the reducing gas, aluminium nitride is produced. The preparation of the alumina from raw materials such as corundum, bauxite, burnt alunite, aluminium silicates such as feldspar and mica, and red bauxite, is described, as well as the recovery of various by-products from them.

LATEST NOTIFICATIONS.

141,656. Chemical Processes in Electrical Furnaces, Method for the Heating of Material in, together with Apparatus intended therefor. Aktiebolaget Kvafveindustri. April 12, 1919.

141,661. Oxygen Compounds of Sulphur, and especially Sulphur Dioxide mixed with Sulphur Trioxide, Apparatus for the Manufacture of. T. A. Clayton. April 11, 1919.

141,666. Alkaline Aluminates, Process for the Preparation of Pure. Rochette Freres. April 16, 1919.

141,688. Electrolytic Treatment of Ores containing Zinc and other Metals. Electrolytic Zinc Co. April 4, 1919.

141,714. Tanning Materials and Method of Producing Same. Rohm & Haas Co. April 12, 1919.

141,720. Fatty Acids with Several Double Linkages, or their Glycerides, Process for the Conversion of, into Oleic Acid-like Fatty Acids or their Soaps. Persapol Ges. May 6, 1914.

141,721. Grinding or Crushing Apparatus. J. M. C. Vanneau. November 9, 1917.

141,733. Electrolytic Method, Apparatus and Product. M. M. Merritt. April 15, 1919.

141,758. HYDROGEN PEROXIDE, Processes for the Production of. Soc. l'Air Liquide. May 11, 1914.

Specifications Accepted, with Date of Application

122,179. Gas or Gases, Process of and means for the manufacture of. C. F. Broadhead. January 7, 1918.

140,831. Chlorhydrins, Manufacture of. R. Haddan. (*Commercial Research Co.*). February 27, 1917.

140,833. Ammonia, Catalytic oxidation of. M. Taliani. April 8, 1918.

140,844. Sulphur, Purification of. J. J. Hood. November 27, 1918.

140,880. Roasting, Mixing, or similar operations, Means for feeding material through a rotating cylinder whilst subjected to. A. Sonsthagen. February 17, 1919.

140,891. Gas generators or the like, Apparatus for agitating the fuel in—and means for operating the same. G. H. Bentley and E. G. Appleby. March 13, 1919.

140,915. Super-phosphate manures, Apparatus for the manufacture of. H. Jones and E. Newell & Co. May 3, 1919.

140,943. Ores or concentrates, Roasting of. U. C. Tainton. June 13, 1919.

140,955. Dinitrophenol, Manufacture of. O. Silberrad. July 10, 1919.

141,001. Vacuum filters, Continuous. A. E. Alexander. (*United Filters Corporation.*) December 30, 1918.

Market Report and Current Prices

Our Market Report and Current Prices are exclusive to THE CHEMICAL AGE, *and, being independently prepared with absolute impartiality by Messrs. R. W. Greeff & Co. and Messrs. Chas. Page & Co., Ltd., may be accepted as authoritative. The prices given apply to fair quantities delivered ex wharf or works, except where otherwise stated. The weekly report contains only commodities whose values are at the time of particular interest or of a fluctuating nature. A more complete report and list are published once a month. The current prices are given mainly as a guide to works managers, chemists, and chemical engineers; those interested in close variations in prices should study the market report.*

Market Report

THURSDAY, April 29.

The volume of business passing during the past week has been very satisfactory, and the demand for all chemicals is again active.

Stocks are very light for most products, and prices on the whole favour sellers.

EXPORT BUSINESS.—Continental business remains quiet owing to the unsettled state of some of the exchanges, but from other overseas markets the demand is unabated, and considerably more business could be done if supplies were available. The restriction in the granting of certain import licences of course also militates against business.

General Chemicals

ACETONE remains in good demand, and the price still shows an advancing tendency.

ACID ACETIC is scarce for prompt and early delivery, and the market is decidedly stronger.

ACID CARBOLIC is quieter, but a steady volume of business is passing on home trade account.

ACID CITRIC is not quite so active, and in one or two cases sellers have made concessions.

ACID FORMIC is in steady demand without change in value.

ACID LACTIC is quiet, and on the whole the price may be said to be a shade easier.

ACID OXALIC is quietly steady at recent rates, with little offering for near delivery.

ACID TARTARIC.—Several holders have shown a tendency to realise their profit and a few parcels have been offered below recent rates. This easier tendency, however, is regarded only as a passing phase as British makers are fully sold, and the foreign producers hold firmly to their quotations, and early delivery is unobtainable.

ALUMINIUM SULPHATE has been in request and quotations favour sellers.

AMMONIUM SALTS are all difficult to obtain, and with the continued heavy demand higher prices are not unlikely. The future outlook on all ammonium products is uncertain, and manufacturers are disinclined to undertake heavy commitments very far ahead.

ARSENIC remains a quiet market and is, perhaps, a shade easier in tendency.

BARIUM SALTS are well inquired for. Makers of chloride are now sold out for the next two or three months, and with the present uncertain position are disinclined to quote for forward.

BLEACHING POWDER is nominally without change in price, although very heavy premiums are paid for export for those parcels which become available.

CALCIUM ACETATE is active and there is perhaps slightly more material available than has recently been the case.

COPPER SULPHATE is still on the quiet side and price continues to favour buyers.

FORMALDEHYDE.—One or two spot parcels have been offered at slightly lower prices, but the available supplies are extremely small, and all makers hold firmly to their quotations.

GLAUBER SALTS are nominally without change on home trade account, but some heavy premiums have been paid for export.

IRON SULPHATE (Green Copperas) is moving off freely without change in value.

LEAD SALTS are inclined to be quiet, but values are steady.

LITHARGE is a shade easier.

POTASSIUM BICHROMATE is without nominal change although, with a few parcels arriving from America, the position may be said to have been slightly eased. There is no appreciable change in price however.

POTASSIUM CARBONATE is moving off fairly well, and prices are without change.

POTASSIUM NITRATE is in request, and English refiners are well occupied with business.

POTASSIUM PERMANGANATE is in request at full figures and stocks are light.

POTASSIUM PRUSSIATE.—The recent advance in price is maintained, and with the demand more active and supplies scarce, higher figures will not be surprising.

SODIUM ACETATE is in good demand, and with the advance in the value of raw materials, higher prices are anticipated.

SODIUM BICHROMATE remains a nominal market, and the small second-hand parcels which appear on the market are immediately absorbed at high figures.

SODIUM CAUSTIC is relatively quiet owing to the restriction of Continental demand, but this tendency is only regarded as transitory, and the available supplies are extremely light.

SODIUM HYPOSULPHITE is again higher in price, and in the absence of supplies quotations are almost nominal.

SODIUM NITRITE has been well inquired for, but business is restricted, owing to the limited arrivals.

SODIUM PHOSPHATE is in request, and higher values are now talked of for this product.

SODIUM PRUSSIATE is a shade easier on the week, and only small business is passing.

SODIUM SULPHIDE continues in most active demand for export, and with makers being fully sold, unheard-of prices are paid for second-hand parcels. A remarkable feature of this material is that the top limit does not appear to have been yet reached.

TIN SALTS are quiet and easy.

Coal Tar Intermediates

This market continues extremely interesting, and while in some cases supplies are slightly better yet for the majority of products, prompt delivery is extremely difficult to obtain. A few export licences have been granted in certain directions.

ANILINE OIL and SALT are both in good request on home and export account.

BENZALDEHYDE can be obtained for prompt delivery, and the price is without change.

BETA NAPHTHOL.—Despite the few arrivals of this material from America, this article is in extremely short supply, and makers are very disinclined to quote at all for future delivery.

DIMETHYLANILINE continues in request, but practically no supplies are available.

DINITROCHLORBENZOL is wanted on export account, but licences are only sparingly granted.

NAPHTHIONATE OF SODA is well inquired for, but early delivery is difficult to obtain.

NITRO BENZOL advanced in price, and trade is very active.

PARANITRANILINE is now almost impossible to obtain for near delivery, and higher prices have been obtained.

SULPHANILIC ACID is well inquired for, and fair business has been done for future delivery.

Coal Tar Products

There has been a slight change in price in one or two of the articles usually mentioned.

90's BENZOL is showing an upward tendency, and is worth about 2s. 8d. on rails.

CREOSOTE OIL remains unchanged at 1s. 1d. in the North, and 1s. 2d. to 1s. 2½d. in the South.

SOLVENT NAPHTHA is worth 2s. 9d. per gallon.

HEAVY NAPHTHA.—Price is about 3s. 3d. to 3s. 6d. per gallon.

NAPHTHALENE is scarce, crude being worth £14 to £18 per ton, and refined from £36. to £40 per ton.

PITCH.—The market is steady and prices are unchanged. The chief interest centres to-day on the position from September forward, but business is limited owing to the pretensions of sellers.

Sulphate of Ammonia

The home demand is still maintained and the quantity available for export at the end of the season will not be large.

Current Prices

Chemicals

	per	£	s	d.		£	s.	d.
Acetic anhydride	lb.	0	3	6	to	0	3	9
Acetone oil	ton	85	0	0	to	90	0	0
Acetone, pure	ton	120	0	0	to	125	0	0
Acid, Acetic, glacial, 99-100%	ton	120	0	0	to	122	10	0
Acetic, 80% pure	ton	95	0	0	to	97	10	0
Arsenic	ton	100	0	0	to	105	0	0
Boric, cryst.	ton	74	10	0	to	76	0	0
Carbolic, cryst. 39-40%	lb.	0	1	4	to	0	1	5
Citric	lb.	0	7	3	to	0	7	6
Formic, 80%	ton	120	0	0	to	125	0	0
Gallic, pure	lb.	0	7	3	to	0	7	9
Hydrofluoric	lb.	0	0	7	to	0	0	8
Lactic, 50 vol.	ton	65	0	0	to	70	0	0
Lactic, 60 vol.	ton	80	0	0	to	85	0	0
Nitric, 80 Tw.	ton	40	0	0	to	42	0	0
Acid, Oxalic	lb.	0	3	0	to	—		
Phosphoric, 1.5	ton	60	0	0	to	65	0	0
Pyrogallic, cryst	lb.	0	11	6	to	0	11	9
Salicylic, Technical	lb.	0	3	0	to	0	3	3
Salicylic, B.P.	lb.	0	3	9	to	0	4	0
Sulphuric, 92-93%	ton	7	15	0	to	8	5	0
Tannic, commercial	lb.	0	5	0	to	0	5	3
Tartaric	lb.	0	4	1	to	0	4	2
Alum, lump	ton	19	10	0	to	20	0	0
Alum, chrome	ton	93	0	0	to	95	0	0
Alumino ferric	ton	9	0	0	to	9	10	0
Aluminium, sulphate, 14-15%	ton	17	10	0	to	18	10	0
Aluminium, sulphate, 17-18%	ton	20	10	0	to	21	10	0
Ammonia, anhydrous	lb.	0	1	9	to	0	2	0
Ammonia, .880	ton	32	10	0	to	37	10	0
Ammonia, .920	ton	20	0	0	to	24	0	0
Ammonia, carbonate	lb.	0	0	7½	to	—		
Ammonia, chloride	ton	95	0	0	to	97	10	0
Ammonia, muriate (galvanisers)	ton	52	0	0	to	54	0	0
Ammonia, nitrate	ton	60	0	0	to	65	0	0
Ammonia, phosphate	ton	135	0	0	to	140	0	0
Ammonia, sulphocyanide	lb.	0	2	3	to	0	2	6
Amyl, acetate	ton	360	0	0	to	370	0	0
Arsenic, white, powdered	ton	67	10	0	to	70	0	
Barium, carbonate	ton	13	10	0	to	14	10	
Barium, carbonate, 92-94%	ton	14	10	0	to	15	0	0
Chlorate	lb.	0	1	4	to	0	1	5
Chloride	ton	35	0	0	to	36	0	0
Barium, Nitrate	ton	50	0	0	to	51	0	0
Sulphate, blanc fixe, dry	ton	25	10	0	to	26	0	0
Sulphate, blanc fixe, pulp	ton	15	10	0	to	16	0	0
Bleaching powder, 35-37%	ton	18	10	0	to	19	10	0
Borax crystals	ton	41	0	0	to	42	10	0
Calcium acetate, Brown	ton	20	0	0	to	21	0	0
,, Grey	ton	41	0	0	to	42	10	0
Carbide	ton	30	0	0	to	32	0	0
Chloride	ton	9	10	0	to	10	10	0
Carbon bisulphide	ton	58	0	0	to	59	0	0
Casein, technical	ton	80	0	0	to	83	0	0
Cerium oxalate	lb.	0	3	9	to	0	4	0
Chromium acetate	lb.	0	1	2	to	0	1	4
Cobalt acetate	lb.	0	7	0	to	0	7	6
Oxide, black	lb.	0	7	9	to	0	8	0
Copper chloride	lb.	0	1	3	to	0	1	6
Sulphate	ton	46	0	0	to	47	0	0
Cream Tartar, 98-100%	ton	310	0	0	to	315	0	0
Epsom salts (*see* Magnesium sulphate)								
Formaldehyde 40% vol.	ton	350	0	0	to	355	0	0
Formusol (Rongalite)	lb.	0	4	0	to	0	4	3
Glauber salts	ton	5	0	0	to	5	10	0
Glycerine, crude	ton	70	0	0	to	72	10	0
Hydrogen peroxide, 12 vols.	gal.	0	2	8	to	0	2	9
Iron perchloride	ton	50	0	0	to	52	0	0
Iron sulphate (Copperas)	ton	4	15	0	to	5	0	0
Lead acetate, white	ton	95	0	0	to	100	0	0
Carbonate (White Lead)	ton	75	0	0	to	77	10	0
Nitrate	ton	75	0	0	to	80	0	0
Litharge	ton	62	10	0	to	65	0	0
Lithopone, 30%	ton	60	0	0	to	62	0	0
Magnesium chloride	ton	15	10	0	to	16	10	0
Carbonate, light	cwt	2	15	0	to	3	0	0
Sulphate (Epsom salts commercial)	ton	14	0	0	to	14	10	0
Sulphate (Druggists')	ton	18	10	0	to	19	10	0
Manganese, Borate	ton	190	0	0	to	—		
Sulphate	ton	105	0	0	to	110	0	0
Methyl acetone	ton	95	0	0	to	100	0	0
Alcohol, 1% acetone	gall.	Nominal						
Nickel ammonium sulphate, single salt	ton	50	0	0	to	52	10	0
Potassium bichromate	lb.	0	2	2	to	0	2	3
Potassium Carbonate, 90%	ton	102	0	0	to	105	0	0
Chloride	ton	Nominal.						
Chlorate	lb.	0	0	10	to	0	0	10½
Meta-bisulphite, 50-52%	ton	270	0	0	to	280	0	0
Nitrate, refined	ton	72	0	0	to	75	0	0
Permanganate	lb.	0	6	6	to	0	6	9
Prussiate, red	lb.	0	6	3	to	0	6	6
Prussiate, yellow	lb.	0	2	4	to	0	2	5
Sulphate, 90%	ton	31	0	0	to	33	0	0
Salammoniac, firsts	cwt.	4	15	0	to	—		
Seconds	cwt.	4	10	0	to	—		
Sodium acetate	ton	66	0	0	to	67	0	0
Arsenate, 45%	ton	60	0	0	to	62	0	0
Bicarbonate	ton	10	10	0	to	11	0	0
Bichromate	lb.	0	2	0	to	0	2	1
Bisulphite, 60-62%	ton	47	10	0	to	50	0	0
Chlorate	lb.	0	0	5¾	to	0	0	6½
Caustic, 70%	ton	43	10	0	to	44	10	0
Caustic, 76%	ton	44	10	0	to	45	10	0
Sodium, Hydrosulphite, powder, 85%	lb.	0	3	9	to	0	4	0
Hyposulphite, commercial	ton	35	0	0	to	37	10	0
Nitrite, 96-98%	ton	120	0	0	to	125	0	0
Phosphate, crystal	ton	40	0	0	to	42	0	0
Perborate	lb.	0	2	2	to	0	2	4
Prussiate	lb.	0	1	10½	to	0	1	11
Sulphide, crystals	ton	28	0	0	to	30	0	0
Sulphide, solid, 60-62%	ton	51	0	0	to	52	0	0
Sulphite, cryst.	ton	14	10	0	to	15	10	0
Strontium, carbonate	ton	85	0	0	to	90	0	0
Nitrate	ton	90	0	0	to	95	0	0
Sulphate, white	ton	8	10	0	to	10	0	0
Sulphur chloride	ton	42	0	0	to	44	10	0
Sulphur, Flowers	ton	25	0	0	to	27	0	0
Roll	ton	24	0	0	to	26	0	0
Tartar emetic	lb.	0	3	5	to	0	3	6
Tin perchloride, 33%	lb.	0	2	6	to	0	2	7
Perchloride, solid	lb.	0	3	0	to	0	3	3
Protochloride (tin crystals)	lb	0	1	11	to	0	2	0
Zinc chloride, 102 Tw.	ton	22	0	0	to	23	10	0
Chloride, solid, 96-98%	ton	60	0	0	to	65	0	0
Oxide, 99%	ton	82	10	0	to	85	0	0
Oxide, 94-95%	ton	70	0	0	to	72	10	0
Dust, 90%	ton	90	0	0	to	92	10	0
Sulphate	ton	21	10	0	to	23	10	0

Coal Tar Intermediates, &c.

	per	£	s.	d.		£	s.	d.
Alphanaphthol, crude	lb.	0	4	0	to	0	4	3
Alphanaphthol, refined	lb.	0	5	0	to	0	5	3
Alphanaphthylamine	lb.	0	3	9	to	0	4	0
Aniline oil, drums extra	lb.	0	1	5	to	0	1	6
Aniline salts	lb.	0	1	10	to	0	2	0
Anthracene, 85-90%	lb.		—		to		—	
Benzaldehyde (free of chlorine)	lb.	0	5	6	to	0	6	0
Benzidine, base	lb.	0	12	6	to	0	13	6
Benzidine, sulphate	lb.	0	10	0	to	0	11	0
Benzoic, acid	lb.	0	5	6	to	0	6	0
Benzoate of soda	lb.	0	5	6	to	0	6	0
Benzyl chloride, technical	lb.	0	2	0	to	0	2	3
Betanaphthol benzoate	lb.	1	6	0	to	1	7	6
Betanaphthol	lb.	0	5	0	to	0	5	3
Betanaphthylamine, technical	lb.	0	8	6	to	0	9	6
Croceine Acid, 100% basis	lb.	0	5	0	to	0	6	3
Dichlorbenzol	lb.	0	0	6	to	0	0	7
Diethylaniline	lb.	0	7	9	to	0	8	6
Dinitrobenzol	lb.	0	1	5	to	0	1	6
Dinitrochlorbenzol	lb.	0	1	5	to	0	1	6
Dinitronaphthaline	lb.	0	1	4	to	0	1	6
Dinitrotoluol	lb.	0	1	8	to	0	1	9
Dinitrophenol	lb.	0	3	6	to	0	3	9
Dimethylaniline	lb.	0	4	9	to	0	5	0
Diphenylamine	lb.	0	4	9	to	0	5	0
H-Acid	lb.	0	13	6	to	0	14	0
Metaphenylenediamine	lb.	0	5	9	to	0	6	0
Monochlorbenzol	lb.	0	0	10	to	0	1	0
Metanilic Acid	lb.	0	7	6	to	0	8	6
Monosulphonic Acid (2:7)	lb.	0	7	6	to	0	8	0
Naphthionic acid, crude	lb.	0	5	6	to	0	6	0
Naphthionate of Soda	lb.	0	6	0	to	0	6	6
Naphthylamin-di-sulphonic-acid	lb.	0	5	6	to	0	6	6
Nitronaphthaline	lb.	0	1	3	to	0	1	4
Nitrotoluol	lb.	0	1	4	to	0	1	6
Orthoamidophenol, base	lb.	0	18	0	to	1	0	0
Orthodichlorbenzol	lb.	0	1	2	to	0	1	4
Orthotoluidine	lb.	0	2	6	to	0	2	9
Orthonitrotoluol	lb.	0	1	8	to	0	1	10
Para-amidophenol, base	lb.	0	15	0	to	0	16	0
Para-amidophenol, hydrochlor	lb	0	15	6	to	0	16	0
Paradichlorbenzol	lb.	0	0	6	to	0	0	8

Company News

BROKEN HILL PROPRIETARY CO.—A dividend of 9d. per share has been declared. A year ago the dividend was the same.

NEUHAUSEN ALUMINIUM.—A dividend of 18 per cent. for the year 1919 is recommended, as against 20 per cent. in the previous year.

ARIZONA COPPER.—The directors recommend a dividend of 9d. per share, free of tax, making 1s. 6d. per share for the year to September 30 last, payable May 31 to holders registered April 28.

LINGGI PLANTATIONS.—A balance dividend has been declared of 20 per cent. (actual), less tax, making 25 per cent. for the year 1919. For 1918 50 per cent. was paid, with, in addition, a bonus in shares equivalent to 300 per cent., paid out of the reserve fund in June, 1919.

BEDE METAL & CHEMICAL.—At an extraordinary general meeting following the forty-seventh annual meeting of the Bede Metal and Chemical Co., Ltd., in Newcastle on Saturday, a resolution was unanimously carried to increase the capital of the company to £229,120 by the creation of 114,560 new shares of £1 each, ranking for dividend and in all other respects *pari passu* with the existing shares of the company.

LYSOL, LTD.—This company has an authorised capital of £750,000 in shares of £1 each, and subscriptions are invited this week to an issue of 100,000 shares at par. The company has been formed to take over as a going concern a private undertaking of the same name, and also the subsidiary company of Lucille Freres, Ltd. The private company was formed in 1914 to manufacture the well-known antiseptic and disinfectant Lysol, which was originally in German hands, but came under British control in that year. Owing to the continually increasing sale the resources of the private company have been taxed to their utmost, and it is necessary that plant on a much larger scale should be laid down.

AMALGAMATED ZINC (DE BAVAY'S).—The report for the half-year ended December 31 states that owing to industrial disputes the mill was shut down during the whole term. The profit was £13,689, including £19,455 increased profit from adjustments in respect of previous periods. The sum of £12,473 was transferred from profit and loss account to appropriation account, from which £9,489 was transferred to reserve for depreciation and £2,985 carried forward to next accounts. The surplus of liquid assets over liabilities amounted to £147,988, not including payments on account of 365,000 tons of tailings paid for but untreated, or £328,785 paid up on 385,710 shares of the Electrolytic Zinc Co. of Australasia Proprietary, and shares in other companies. For the corresponding period a year ago the profit was £34,812, which included £6,427 increased profit in respect of adjustments on concentrates dealt with in previous periods. The dividend for the year to December 31 amounts to 5 per cent., compared with 20 per cent. paid in 1918.

NITRATE RAILWAYS CO.—The gross receipts for the year 1919 were £485,143, and the net receipts £95,790, against £841,497 and £152,395 respectively for 1918. Including the balance brought in, the balance of interest, &c., and transfer fees, a total is shown to credit of net revenue of £164,697. From this amount must be deducted expenses on bearer shares, French taxes, &c., income tax and loss on sale of investments, amounting together to £64,300, the expenditure during the year on new sidings and buildings amounting to £12,085, and £30,000, the annual provision for additions and renewals of locomotives and rolling stock. After making the above deductions there remains a balance of £58 311, which the directors propose to carry forward. The decrease in receipts is due to the great falling off in traffic, the cargo carried in 1919 being 45 per cent. less than that carried in the previous year. The total export of nitrate of soda during 1919 amounted to 19,892,421 quintals, of which 8,263,620 were shipped in Iquique and Pisagua and carried by the Nitrate Railways Co.

Mason & Barry

Mr. J. F. Mason (chairman), presiding at the annual meeting of Mason & Barry, Ltd., in London on Monday, explained that the difficult year through which they had passed was due to the large stocks of pyrites and other raw material for making the acid required in munition manufacture which, on the cessation of hostilities were thrown on to the market by the chief belligerent countries of Europe, for absorption by ordinary customers. Consequently the demand for the Company's chief product was, during the first part of 1919, very small, and the position was further aggravated by the shortage of available ships and consequent high freights. During the last few months of the year, as Government stocks gradually became exhausted and works were reconditioned on the Continent, the demand for fresh ore improved and shipping was then slightly easier. With the pyrites market in such a depressed state (the total exports of pyrites from the Iberian ports in 1919 being about one-fourth of the pre-war average) they considered themselves fortunate to receive an offer for the larger part of their production for a number of years, delivery f.o.b. Pomaron, to begin in July next.

With regard to the immediate prospects Mr. Mason said that taking a long view he was of opinion that the world demand for pyrites must increase. High-class basic slag was being produced on a smaller scale owing to the loss of iron involved, and therefore super-phosphate must become more and more sought after, thus increasing the demand for sulphuric acid. Some form of phosphatic manure was necessary for intensive agriculture. On the other hand, the sources of supply of pyrites were not materially increased, although the use of brimstone in America, by a new method of extraction, appeared to be a strong competitor in the manufacture of acid.

A dividend of 10 per cent. was declared.

Tharsis Sulphate and Copper

At the annual meeting of the Tharsis Sulphur & Copper Co., at Glasgow last week, Lord Glenconner, who presided, referring to operations of the company in this country, said their works were kept fully employed towards the end of the year, when the reduction in pyrites imported began to be felt by the reduced quantities of cinders available at the works, and their Willington works had then to be closed down. With respect to prospects, they expected a greater export of ore this year than was the case last year. The price of copper was distinctly low, but this metal was entirely under the control of the American producers. As to the sulphur in the company's ore, they heard much about competition, and it was possible that they might require to enlarge their business operations in order to make themselves more independent in certain directions than they had been hitherto. They had properties capable of indefinite expansion and well-equipped works in this country; and he felt that, given settled world conditions and a good demand for their natural products, they could look on the future with confidence. So far, this year promised rather better than last. He concluded by proposing a resolution adopting the report and declaring a dividend of 5s. per share, equal to 12½ per cent., less income tax at 6s. in the pound. Mr. Samuel C. Hogarth seconded the motion, which was carried unanimously.

Standard Petroleum Exploration Co.

Separate meetings of the First Lien Debenture Holders, Prior Lien Debenture Holders, First Debenture Holders and Second Debenture Holders of the above company will be held at the office of William A. Crump & Son, 17, Leadenhall Street, London, on Monday, May 10, at 11 a.m., 11.15 a.m., 11.30 a.m. and 11.45 a.m., respectively. The meetings are called for the purpose of considering a scheme of arrangement proposed to be made between the company and the Debenture Holders.

A Lewes correspondent points out that the humorous verses on Hexahydrobenzene, which we quoted last week from the *Daily Chronicle*, should have been described as "a short poem," and not as a "sonnet." Quite right!

SIR W. H. BRAGG, in proposing "The Royal College of Science" at the annual dinner held at the Café Monico on Saturday, April 24, said that since the war they found a new attitude towards science and scientific research. They could not keep young men at the universities; they were all drawn away to commerce and industry. Students were pouring in from all sides and at the same time the supply of teachers was falling off. Among those present were Sir Richard Gregory (presiding), Professor Sir Richard Glazebrook, Sir Daniel Hall, Sir Frank Heath, Sir Alfred Keogh, Sir Ronald Ross, Sir Napier Shaw, Professor J. C. Philip, Professor H. E. Armstrong, Mr. H. Wright, Dr. Garnett, Mr. A. Gow, Mr. W. McDermott, Mr. F. E. Smith, Professor Hinchley, Mr. L. Bairstow, and Professor Morgan.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

London Gazette

Notice of Dividend

THE PETROL PROCESS SYNDICATE, LTD., 3, Copthall Buildings, London. 2s. 5½d. first and final. Any day (except Saturday) between 11 and 2 at the office of the Official Receiver and Liquidator, 33, Carey Street, Lincoln's Inn, W.C.2.

Notice of Intended Dividend

ROUMANIAN OIL TRADING CO., LTD., 31, Lombard Street, London. May 26. Harold de Vaux Brougham, Senior Official Receiver and Liquidator, 33, Carey Street, Lincoln's Inn, London, W.C.2.

Liquidators' Notices

BISSOE TIN SMELTING & ARSENIC CO., LTD.—A general meeting will be held at 11, Ironmonger Lane, E.C.2, June 2, at 12 noon. R. B. Pitre, Liquidator.

TARANAKI (NEW ZEALAND) OIL WELLS, LTD.—Creditors' claims on or before Friday, June 4, to the Liquidator, R. F. W. Fincham, 3, Warwick Court, Gray's Inn, London, W.C.

Companies Winding Up Voluntarily

BROUGHTON DYE MANUFACTORY, LTD. (in voluntary liquidation).—A meeting of creditors will be held at the Chartered Accountants' Hall, 60, Spring Gardens, Manchester, on Tuesday, May 4, at 3 p.m. A. Thwaites (of Dickinson, Thwaites & Co.), 105, Market Street, Manchester.

LONDON METAL CO., LTD. (in voluntary liquidation).—A general meeting of members will be held at the offices of the Company, Suffolk House, Laurence Pountney Hill, Cannon Street, E.C.4, on Tuesday, May 25, at 2.30 p.m. D. J. Cartledge, Liquidator.

MIDDLESBRO' SLAG CO., LTD.—Liquidator, S. W. Rowland, 27, Chancery Lane, London, W.C.2.

PETROLEUM EXPLORATION CO., LTD.—A general meeting of members will be held at 15, Angel Court, Throgmorton Street, London, E.C., Monday, May 31, at 11 a.m. W. A. Habberfield, Liquidator.

TRINIDAD MONTSERRAT PETROLEUM CO., LTD.—A general meeting of members will be held at 15, Angel Court, Throgmorton Street, London, E.C., Monday, May 31, at 11.15 a.m. L. V. C. Briggs, Liquidator.

TRINIDAD WESTERN CENTRAL PETROLEUM CO., LTD.—A general meeting of members will be held at 15, Angel Court, Throgmorton Street, London, E.C., Monday, May 31, at 11.30 a.m. L. V. C. Briggs, Liquidator.

YORKSHIRE OIL STORAGE CO., LTD.—Liquidator, J. W. Barratt, 19A, Coleman Street, London, E.C.3.

Mortgages and Charges

[*NOTE.—The Companies Consolidation Act, of* 1908, *provides that every Mortgage or Charge, as described therein, created after July* 1, 1908, *shall be registered within* 21 *days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges which would, if created after July* 1, 1908, *require registration. The following Mortgages and Charges have been so registered. In each case the total debt, as specified, in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced since such date.*]

KING ASBESTOS (RHODESIA), LTD., LONDON, E.C.—Registered April 7 (by order on terms), mortgage or charge securing £15,000, to National Bank of South Africa, Ltd.; charged on blocks of asbestos claims, &c., at Victoria, Southern Rhodesia, with buildings, plant, machinery, &c. *——. August 6, 1919.

SELBY CHEMICAL CO., LTD., SELBY.—Registered April 15, £7,000 debentures; general charge. *Nil. September 17, 1919.

Satisfactions

BRITISH MAIKOP OIL CO., LTD., LONDON, E.C.—Satisfactions registered April 14, £15,000, registered July 3, 1914; £7,500, registered June 6, 1918; and £50, registered June 17, 1918.

New Companies Registered

The following list has been prepared for us by Jordan & Sons Ltd., company registration agents, 116 and 117, Chancery Lane, London, W.C.:—

ALCOHOL FUEL CORPORATION, LTD., 7, Princes Street, Westminster.—Producers and refiners of alcohol, petroleum and other oils. Nominal Capital, £100,000 in 100,000 shares of £1 each. Directors, to be appointed by subscribers. Qualification of directors, one share.

ATMOSTEROL, LTD., The Mooring's, Nelson Drive, Leigh-on-Sea.—Engineers, chemists, &c. Nominal Capital, £1,000 in 20,000 shares of 1s. each. Directors, to be appointed by subscribers. Qualification of directors, one share. Remuneration of directors, £200 each.

FORDATH ENGINEERING CO., LTD., Hamblet Works, West Bromwich.—Merchants and dealers in animal, mineral and vegetable oils and lubricating oils of all kinds. Nominal Capital, £5,000 in 5,000 shares of £1 each. Directors: J. W. Athey and J. W. Sutcliffe. Qualification of directors, £500.

GARNETT & BIRD, LTD., chemical merchants, brokers and shippers. Nominal Capital, £2,500 in 2,500 shares of £1 each. Directors: W. J. Cranley, 39, Popes Grove, Strawberry Hill, Middlesex; G. H. Wells, 204, Leigh Road, Leigh-on-Sea; A. E. Winnett, 7, St. Vincent Road, Westcliff. (All first directors.) Qualification of directors, 100 shares (first directors). Remuneration of directors, £200 each (first directors).

GRAHAM (WALTER) & CO., LTD., seed crushers, refiners, &c.—Nominal capital, £30,000 in 30,000 shares of £1 each. Directors, F. M. Williams, 4, Lansdown Place, Blackheath, S.E. (managing director); F. C. Williams, 4, Lansdown Place, Blackheath, S.E. Qualification of directors, £100. Remuneration of directors, £1,000; managing director, F. C. Williams, £200.

LYSOL, LTD., 9 and 10 St. Mary-at-Hill, E.C.—To manufacture surgical and other antiseptics, disinfectants, &c. Nominal Capital, £150,000 in 150,000 ordinary shares of £1 each. Minimum subscription, 7 shares. Directors: C. Bell, 9 and 10, St. Mary-at-Hill, E.C.; S. H. Marshall, Bracklin, Belmont, Surrey; E. J. Parry, 56A, Great Dover Street, S.E. Qualification of directors, £500. Remuneration of directors, £500 to be divided.

MIDLAND TEXTILE SOAP AND CHEMICALS, LTD.—Manufacturers of textile and household soaps, chemicals, disinfectants and oils. Nominal Capital, £10,000 in 10,000 ordinary shares of £1 each. Directors: C. H. Riley, Ashbourne Road, Derby; W. Riley, 40, Breedon Hill Road, Derby; T. W. Riley, 45, Normanton Road, Derby; A. Webb, 19, Stockbrook Street, Derby. (All permanent Directors.) Qualification of Directors, 500 ordinary shares.

NURSE (E. E.), LTD.—Manufacturers of feeding stuffs, oil and linseed cakes. Nominal Capital, £10,000 in 9,950 preference shares of £1 each and 1,000 ordinary shares of 1s. each. Directors: To be appointed by Subscribers. Qualification of Directors £50 shares. Remuneration, £50 each. Subscribers: E. E. Nurse, 14, Haverstock Road, Knowle, Bristol; J. McGregor Johnson, 7, Westlecot Road, Swindon.

PREMIER ELECTRIC WELDING CO. (SWANSEA), LTD.—Reg. April 14, 1920, to carry on the business of welding of metals by electrical, oxy-acetylene or any other process. Nominal Capital, £20,000 in 20,000 shares of £1 each. Directors, to be appointed by subscribers. Qualification of directors, £100. Remuneration of directors, £100 each. Subscribers, J. G. de O. Coke, Bank Buildings, St. James's Street, S.W.1; A. L. Haggerty, Bank Buildings, St. James's Street, S.W.1.

SHAKESPEARE MANUFACTURING CO., LTD., 7, Denman Street, S.E.1.—Manufacturers of all kinds of chemical products and by-products. Nominal Capital, £100, in 60 cumulative participating preference shares of £1 and

40 ordinary shares of £1 each. Directors, A. C. Russell, 3, Strathyre Avenue, Norbury, S.W.16. Qualification of directors, one share.

SISSONS BROTHERS & CO., LTD., Bankside, Sculcoates, Kingston-upon-Hull.—Paint, colour, oil and varnish manufacturers, and merchants. Nominal Capital, £500,000 in 250,000 par. cumulative preference shares of £1 each and 250,000 ordinary shares of £1 each. Directors: T. H. Sissons, D. H. Sissons, H. H. Sissons, O. H. Sissons and six others. Qualification of Directors, £500.

SOUTHERN COUNTIES TAR MACADAM, LTD., 14, Victoria Street, S.W.1.—Manufacturers of tar, tar macadam, &c. Nominal Capital, £5,000 in 5,000 shares of £1 each. Directors: F. C. Linfield, 86, Huron Road, Upper Tooting, S.W.17. Qualification of Directors, £5.

TAR OILS, LTD.—Manufacturers of oils and products derived from tar. Nominal Capital, £15,000 in 15,000 shares of £1 each. Directors to be appointed by Subscribers. Subscribers: N. R. D. Crockes, 43, Lansdowne Road, Bedford; W. Phillips, Gas Works, Luton, Beds.

WASHINGTON CHEMICAL CO., LTD., Woodland Road, Spotland, Rochdale.—Spinners and doublers of asbestos, cotton and other fibrous substances and manufacturers of chemical products. Nominal Capital, £100 in 100 shares of £1 each. Directors, F. S. Newall, Castle Hill, Wyham, Northumberland; G. A. Newall, Sunniside, Hexham, Northumberland.

Perry, Mills & Co.

JOHN ALGERNON HARE DUKE and Henry Slater, trading as Perry Mills & Co., merchants and agents, 61-2, Gracechurch Street, E.C., who failed in August last, applied at the London Bankruptcy Court on Tuesday, April 27, for an order of discharge.

The Official Receiver reported that the debts amounted to £15,175, and that the assets, valued at £3,137, had so far realised £440 19s. 6d. The future realisations depended on the sale of the balance of the stock, but in the opinion of the trustee (Mr. C. L. Sixsmith) the dividend, if any, would be very small. The debtors attributed the failure and insolvency to the omission of their foreign customers to take delivery of goods and to the heavy fall in prices in November 1918. The facts of the case were published in THE CHEMICAL AGE of September 6 and December 20, 1919.

In opposition to the discharge the Official Receiver submitted (1) that the assets were less than 10s. in the £, and (2) that the debtors, after March 1919, traded with knowledge of insolvency.

Mr. Registrar Mellor, giving judgment, said that the debtors' position was fundamentally altered by the armistice and what he had to consider was their conduct after that time. They were being sued by the petitioning creditors in March after they had incurred losses amounting to something like £24,000. He thought that the Official Receiver was justified in assuming that the debtors must have realised in March that their position was so serious as to be almost hopeless. Since then they had contracted debts of about £3,000, and they ought in that month to have placed themselves in the hands of their creditors. He did not, however, consider that the offence was a serious one and if counsel had been able to make a reasonably substantial offer he would have been prepared to grant an immediate discharge. But the liabilities were too heavy for him to grant a discharge on so small a judgment as counsel suggested. In these circumstances the discharge must be suspended for two years.

MR. W. RAITT, cellulose expert to the Government of India, is, it is stated, at present on a visit to this country in connection with the development of the pulp resources of India, but primarily to obtain pulping plant for the Forest Research Institute in India. The plant is needed for further experimental work in investigating new sources of paper-making material and for assisting the development of bamboo pulp enterprises.

The Affairs of G. E. E. Newton

AN adjourned sitting for the public examination of George E. E. Newton, wholesale chemist, late of 74, Great Tower Street, E.C., was held on Friday, April 23, at the London Bankruptcy Court, a statement of his affairs showing gross liabilities £7,627. 12s. 2d., of which £2,090. 13s. 4d. was expected to rank for dividend, against assets £8. 1s. 4d.

In answer to the Official Receiver, the debtor said that in 1916 he began business on his own account as a chemical merchant and exporter at 74, Great Tower Street, under the style of G. E. Newton & Co. His net profits for the first 18 months of his trading amounted to about £3,000, with which he purchased stock. Towards the end of 1918 his business decreased, owing to restrictions on exports and the Government control of chemicals. Immediately after the armistice the business came to a standstill, and he had to borrow from moneylenders. He had never prepared a profit and loss or trading account, though one was in the course of preparation when the bankruptcy petition was presented. This was for the purpose of converting his business into a limited company, but the bankruptcy prevented his proceeding with the matter. He estimated that he lost £1,500 through depreciation of his stock-in-trade, and the interest on borrowed money amounted to £1,000. He was now in employment at a salary of £4 a week.

The examination was further adjourned for a month.

Imports and Exports of Chemicals

The following figures relating to the imports and exports for January, 1919, and January, 1920, of certain chemicals have been issued by the Bureau of Foreign and Domestic Commerce:—

Exports of Chemicals.

	Jan., 1919.		Jan., 1920.
Acids:	lb.		lb.
Carbolic	229,497	...	440,832
Nitric	49,411	...	13,276
Picric	22	...	5,567
Sulphuric	1,067,763	...	1,768,749
Calcium acetate	55,765	...	3,632,782
Calcium carbide	2,286,388	...	736,959
Calcium chloride	1,579,847	...	2,983,782
Copper sulphate	2,847,199	...	346,947
Potassium chlorate	410,979	...	409,154
Soda:			
Caustic	17,402,125	...	14,180,004
Sal soda	1,453,780	...	552,193
Soda ash	15,034,056	...	5,676,972
Sodium silicate	2,008,597	...	1,771,143
	Value.		Value.
Dyes and dyestuffs	$2,318,061	...	$1,449,153

Imports of Chemicals.

	Jan., 1919.		Jan., 1920.
	lb.		lb.
Calcium acetate and chloride (crude), carbide and nitrate	11,260,828	...	5,684,135
Dyes	216,952	...	539,144
Gums	4,694,962	...	12,328,990
Potassium carbonate, including crude or black salts	120,953	...	1,289,938

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